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# A 1991 SOCIAL ACCOUNTING MATRIX (SAM) FOR ZIMBABWE

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**M**ACRO
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**S**OUTHERN
**A**FRICA

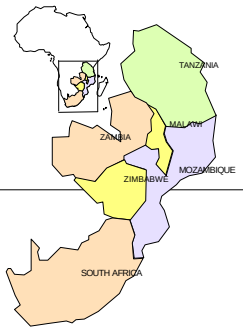

**Table of Contents**

**Abstract**

The 1991 Social Accounting Matrix (SAM) for Zimbabwe that we document in this paper is intended to provide benchmark data for economy-wide analysis under the MERRISA Project. Its construction is based on a three-step process: (1) building a macro SAM that presents the aggregative features of the Zimbabwean economy and serves as a control matrix for the micro SAM; (2) disaggregation into a complete but unbalanced micro SAM; and (3) balancing the disaggregated and complete micro SAM using the cross-entropy approach. The macro SAM entries are based on aggregates from a recent, significant revision of the Zimbabwe national accounts for 1991. The structure of the micro SAM is a disaggregated version of the macro SAM. The outcome is an 88 by 88 matrix that includes 36 activities, 27 commodities, 9 factors of production (4 labor , 3 capital, and 2 land categories), 5 households groups, and one account each for enterprises, government, investment/saving, and rest-of-the-world. Among the significant features of the Zimbabwean economy that are explicitly taken into account in the SAM structure are the importance of agriculture, the distinction between smallholder and large-scale commercial farms, home consumption by smallholder farm households, and the large marketing margins that reflect inefficiencies in trade and transport infrastructure.

## List of abbreviations

| | |
|---|---|
| CGE | Computable General Equilibrium |
| CIF | Cost Insurance and Freight |
| CIP | Census of Industrial Production |
| CSO | Central Statistical Office |
| ESAP | Economic Structural Adjustment Program |
| FOB | Free on Board |
| GAMS | General Algebraic Modeling System (software) |
| GDP(f.c.) | Gross Domestic Product at factor cost |
| GFCF | Gross Fixed Capital Formation |
| GEMINI | Growth and Equity through Micro-enterprise Investments and Institutions |
| ICES | Income Consumption and Expenditure Survey |
| I/O | Input-Output |
| LSC | Large- scale commercial |
| MERISSA | Macroeconomic Reforms and Regional Integration in Southern Africa |
| NA | National Accounts |
| QDS | Quarterly Digest of Statistics |
| ROW | Rest of the World |
| SAM | Social Accounting Matrix |
| SH | Small holders (mostly communal) |

## 1. Introduction

The IFPRI research project on Macroeconomic Reform and Regional Integration in Southern Africa (MERRISA) aims to study the effects of recent macroeconomic policy adjustments on economic growth and equity for six countries in Southern Africa, namely, Malawi, Mozambique, South Africa, Tanzania, Zambia, and Zimbabwe. As a first step in each county study, a social accounting matrix (SAM) is constructed, with emphasis on agriculture, poor households, and their linkages to the rest of the economy. The 1991 SAM for Zimbabwe that we document in this paper is intended to provide benchmark data for economy-wide analysis, in particular based on SAM multipliers and computable general equilibrium (CGE) modeling.

A SAM is a square table describing quantitatively the transactions taking place in an economy during a specified period of time.[1] Each account in the SAM is represented by a row and a column of the table; by convention, each cell of the matrix represents an expenditure by the column account and an income to the row account. The underlying principle of double-entry accounting requires that total revenue (row total) must equal total expenditure (column total) for each account in the SAM. The SAM integrates national income, input-output, flow-of-funds, and foreign trade statistics into a comprehensive and consistent dataset.

SAM construction in developing countries is often made difficult by insufficient and fragmented data sources as well as by problems of data reliability. The following characteristics of our benchmark SAM for Zimbabwe are worth noting:

i. It is for *1991*, providing therefore a useful starting point for analyzing the effects of reform measures under the Economic Structural Adjustment Program (ESAP) initiated in that year. 1991 can be considered a "normal" year in at least one important respect: unlike the subsequent years, agricultural production and trade were not disrupted by the severe droughts of 1992 and 1995.

ii. It has an *agricultural focus* (15 out of 27 production sectors are in agriculture), and captures the highly dualistic agrarian economy of Zimbabwe by distinguishing between large-scale commercial (LSC) and smallholder (SH) farms.

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[1] See Pyatt and Round (1985) for a discussion of the SAM structure, and de Melo (1988), Pyatt (1988), and Robinson and Roland-Holst (1988) for perspectives on SAM-based modeling.

iii. The *household classification* reflects differences in the level and source of incomes as well as in the consumption patterns of various household groups. Five household categories are distinguished: LSC upper-income households (owners and managers), LSC farm-worker households, SH farm households, urban high-income, and urban low-income households.

iv. *Marketing margins* are explicitly taken into account — differentiating among domestic, export, and import products — to reflect deficiencies in trade and transport infrastructure.

v. Household *home consumption* or consumption of own production is distinguished from the consumption of marketed goods. It represents the output of smallholder farm households used for their own needs and therefore never reaches the market. Consequently, it is not subject to marketing margins.

vi. Measures of *informal activities* are included in the formulation of production value added in agricultural and non-agricultural activities.

Estimation of the Zimbabwe SAM in the present study has involved a three-step process:

i. *Building a macro SAM*: The aggregative features of the Zimbabwean economy are contained in the macro SAM, which serves as the control matrix for the micro SAM. The cell entries in the macro SAM are based for the most part on aggregates from the National Accounts (NA).

ii. *Generating the micro SAM*: This is a process of disaggregation and estimation. Each cell entry in the macro SAM corresponds to a matrix of accounts in the micro SAM. For example, GDP is distributed among nine factors of production and 36 production activities; similarly, private consumption is distributed among five household groups and 27 commodities. This process results in an unbalanced but complete micro SAM, called the "protoSAM."

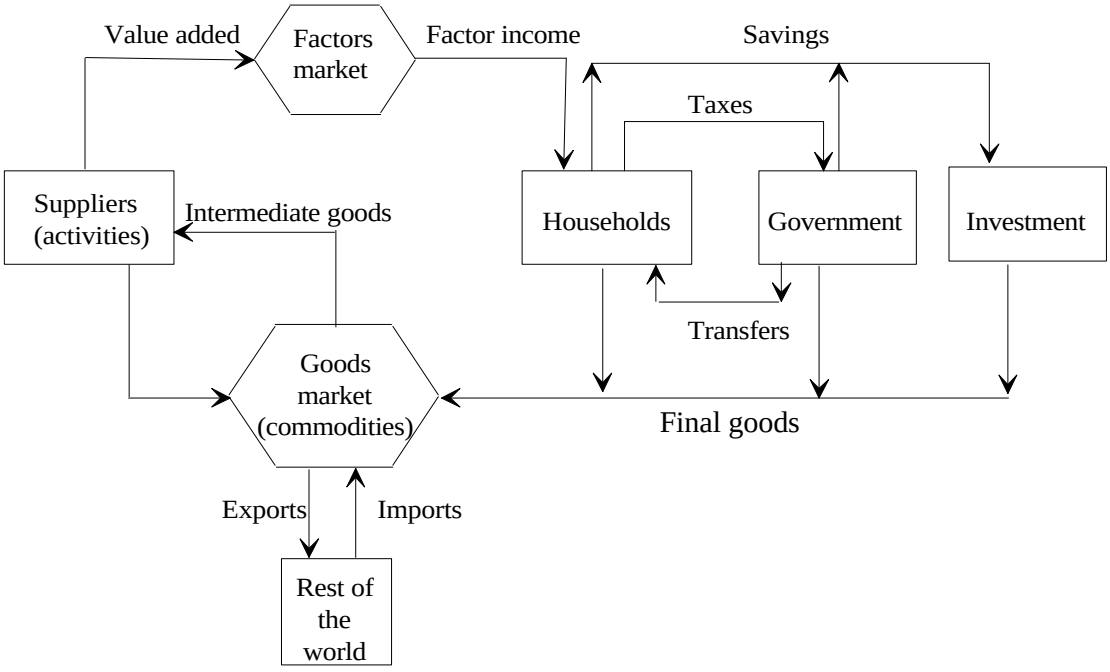
iii. *Balancing the micro SAM*: In the micro SAM, as well as in the macro SAM, total income must equal total expenditure for each account. Balancing the SAM requires the estimation of new entry values that will insure equality between the column and row totals in each account. The cross-entropy approach is an appropriate tool to carry out these estimations (see Robinson et al. 1998). It finds a new set of SAM coefficients that minimizes the "entropy distance" between prior coefficients from the

protoSAM and the new estimated coefficients, given various constraints imposed on the basis of prior knowledge about any part of the SAM.

## 2. A macro SAM for 1991

A simplified framework for economy-wide analysis is shown in Figure 1. It traces the circular flow of incomes from product markets through factor payments to households and back to product markets through expenditures on final goods. Additionally, income flows involving producers, government, rest-of-the-world, and the capital account are included in the diagram (Dervis et al. 1982).

Figure 1 — Economy-wide circular income flow




Most of the economic transactions represented in Figure 1 are quantified aggregatively in a country's national accounts, as shown in Table 1 for Zimbabwe in 1991. These aggregate income flows form part of the macro SAM that shows in more detail the economic linkages among producers, consumers and markets in the economy.

Following conventional accounting standards, the macro SAM embodies the following principles:

- First, the SAM requires that any purchase, expenditure or flow of money from any account is a sale, income or flow of money to one or more other accounts. For example, the incomes generated by factors of production (labor, land, and capital) are distributed entirely to households and enterprises.

- The second principle requires that, in each account, total income equals total expenditure. For example, the total income generated by each activity from the sale of output and the value of home consumption must equal the total expenditure on inputs, factors of production and domestic indirect taxes.

In view of these principles, the macro SAM entries are derived for the most part from the national accounts aggregates. The balance sheet in Table 1 shows the correspondence between gross domestic income and expenditure items in the national accounts. Entries such as GDP at factor cost, final consumption by households and government, gross capital formation, exports and imports, and foreign saving are reported exactly in the macro SAM as they appear in the balance sheet. Entries requiring some level of disaggregation are derived from other tables in the national accounts such as the central and local government budget tables. This process insures balance and consistency among the different accounts.

The structure of the macro SAM (Table 2) can be described briefly as follows:

- Production *activities* purchase *intermediate inputs* from the *commodities* account and also the services of primary *factors.*

- The output is either retained by producers for *home consumption* or sold on the market (*sales*).

- *Factors* of production distribute their income to *enterprises, households*, and the *rest-of-the-world (ROW*).

- Retained earnings from *enterprises* (capital income net of corporate taxes and saving) are distributed to *households* and *ROW*.

- H*ouseholds* and *enterprises* receive *factor* payments and income transfers from other *households*, *government,* and *ROW*.

Table 1 — Zimbabwe National Accounts balance sheet for 1991 (Z$ million)

| ***GDP*** | ***INCOME*** | ***EXPENDITURE*** | |
|---|---|---|---|
| GDP f.c. | 26,284 | Government consumption | 4,775 |
| Indirect taxes | 3,339 | Private consumption | 20,163 |
| | | Gross capital formation | 5,658 |
| | | Exports | 7,075 |
| | | less imports | (8,048) |
| **Total (GDP m.p)** | **29,623** | | **29,623** |
| ***GNP*** | ***INCOME*** | ***EXPENDITURE*** | |
| Wages & salaries | 11,239 | Final consumption | 24,938 |
| Rent | 529 | Gross saving | 4,099 |
| Gross operating surplus (less imputed banking charges) | 14,516 | Net factor income paid abroad | 979 |
| Indirect taxes | 3,339 | | |
| Net current transfer from abroad | 393 | | |
| **Total (GNP)** | **30,016** | | **30,016** |
| ***Capital Accounts*** | ***INCOME*** | ***EXPENDITURE*** | |
| Domestic saving | 4,099 | Gross capital formation | 5,658 |
| Foreign saving | 1,559 | | |
| **Total** | **5,658** | | **5,658** |
| ***Rest of the world*** | ***INCOME*** | ***EXPENDITURE*** | |
| Imports | 8,048 | Exports | 7,075 |
| Net factor income | 979 | Net current transfer | 393 |
| | | Surplus | 1,559 |
| **Total** | **9,027** | | **9,027** |

Source: *National Accounts 1985-1996*, (CSO 1998a).

Table 2 — Zimbabwe: Macro SAM structure

| | **Activities** | **Commodities** | **Factors** | **Enterprises** | **Households** | **Government** | **Capital** | **ROW** | **TOTAL** |
|---|---|---|---|---|---|---|---|---|---|
| **Activities** | | Sales | | | Home consumption | | | | **Total domestic production** |
| **Commodities** | Intermediate inputs | Marketing margins | | | Private consumption | Government consumption | Investment expenditures | Exports | **Total marketed supply** |
| **Factors** | Value added | | | | | | | | **Total factor income** |
| **Enterprises** | | | Capital income | | | Transfers | | | **Total enterprise income** |
| **Households** | | | Labor income | Retained earnings | Inter household transfers | Transfers | | Remittances | **Total household income** |
| **Government** | Indirect taxes | Import tariffs | | Corporate taxes | Income tax | | | Foreign grants | **Total government income** |
| **Capital** | | | | Corporate saving | Household saving | Government saving | | Foreign saving | **Total saving** |
| **Rest of the world(ROW)** | | Imports. | Factor income paid to ROW | Enterprise income paid to ROW | | Government income paid to ROW | | | **Total foreign exchange outlays** |
| **TOTAL** | **Total cost of production** | **Total absorption** | **Total value added** | **Total enterprise expenditure** | **Total household expenditure** | **Total government expenditure** | **Total investment** | **Total foreign exchange earnings** | |

- Incomes received by institutions are spent on final goods and services, i.e., private consumption in the case of *households*, current expenditures in the case of *government*, and investment in the case of the *capital account*.

- The *government* derives income from the levy of indirect taxes on *activities* and *commodities* and direct taxes on *enterprises* and *households*.

- The *capital account* receives payments from *enterprises*, *households*, *government*, and *ROW* in the form of saving.

- The *ROW* account identifies flows between the domestic and the foreign sectors, of which the main components are imports and exports of *commodities.* It also receives additional income and incurs additional expenditures in the form of factor income and current transfers (*remittances* and *grants*).

## 2.1. Data sources

The recently revised set of National Accounts (CSO 1997 and 1998a) is used as the principal data source to construct the macro SAM. A few entries are based on data from other sources. Marketing margins rates are derived from the 1980 I/O table (CSO 1988). Total home consumption is estimated from the *Production Account of Agriculture, Forestry and Fishing* for communal lands (CSO 1996a). Inter-household transfers (their shares of total income) are estimated from the *Income Consumption and Expenditure Survey* (CSO 1994). Table 3 gives a detailed description of the data sources used in building the macro SAM.

## 2.2 Cell entries for the macro SAM

The macro SAM is built on the basis of the NA aggregates shown in Table 1 and the simplified structure of the economy described in Table 2. For some entries further disaggregation is necessary. Gross saving, for example, must be allocated to households, enterprises, government and ROW. It is also necessary to construct the government budget to determine the receiving institutions of government expenditures as well as the structure of taxes which constitute government income.

The following describes the macro SAM cell entries and identifies their sources. The cell entries are referenced by their "row-column" location, i.e., intermediate inputs are in the cell "*commodity-activity*". All entries are in 1991 Z$ million.

Table 3 — Data sources for the macro SAM

| Source documents | Data extracted | Macro SAM Entries |
|---|---|---|
| **National Accounts 1985-1996 (Harare: CSO, 1998a).** | | |
| *Table 2.5 GDP Income* | • Wages and salaries | • Labor income |
| | • Gross operating profit + rent | • Capital income<br>• GDP f.c. |
| | • Net taxes on production + Net taxes on products | • Total indirect taxes |
| | • Net factor income from abroad | • Net factor income paid to ROW. |
| *Table 3.1(a) Expenditure on GPD* | • Private consumption + Consumption of private non profit bodies | • Household consumption (net of home consumption) |
| | • Government consumption expenditure | • Government consumption |
| | • Gross fixed capital formation + Total increase in stocks | • Capital expenditure ( private and public) |
| | • Exports of goods and services | • Exports |
| | • Imports of goods and services | • Imports |
| *Table 6.1 External Transaction on Current Account* | • Net primary income paid to the ROW<br>- Compensation to employees | • Net factor payments to ROW by factors |
| | - Property and entrepreneurial income paid by:<br>General government | • Net factor payments to ROW by government |
| | Enterprises | • Net factor payments to ROW by enterprises |
| | • Net current transfer from ROW | • Transfer from ROW to households<br>• Foreign grant from ROW to government |
| | • Surplus of the nation on current transactions | • Foreign saving (current account deficit) |
| *Table 7.3 Production account* | • Intermediate consumption | • Intermediate consumption |
| | • Value added | • Value added |
| *Table 7.6 Saving by Type of Institution* | • Public corporations (parastatals) + Private financial institutions | • Corporate saving |

Table 3 — Cont'd.

| Source documents | Data extracted | Macro SAM Entries |
|---|---|---|
| *Tables 7.9(a), 7.9(d), 7.10(b) and 7.10 (c) Central and Local Government revenue and expenditure* (Tables on Central and Local government are added to estimate total government income and expenditure.) | • Individual income tax<br>• Corporate and other unallocable income tax<br>• Domestic taxes net of subsidies<br>• International taxes<br>• Government expenditure on goods and services less fees sales & recoveries<br>• Lending minus repayment<br>• Subsidies to parastatal and Interest payment .<br>• Foreign grants<br>• Balance on current revenue and expenditures | • Household taxes<br>• Corporate taxes<br>• Domestic indirect taxes<br>• Import tariff<br>• Government consumption of goods and services<br>• Transfers to households<br>• Transfers to enterprises<br>• Foreign grants<br>• Government current deficit |
| **Production Account of Agriculture 1996a.** | | |
| *Table 1.5 Production Account of Agriculture, Communal Lands, 1982-1993 Including Resettlement Areas.* | • Production for own consumption | • Home consumption |
| **Income Consumption and Expenditure Survey Report 1990/91 (CSO 1994).** | | |
| *Table 3.3(a): Average Annual Household Income by Type of Income (1990/91)* | • Transfer and gift | • Inter-household transfer (as share of household cash income) |

**Domestic production ("*activities-commodities*"): 47,823**—Domestic marketed supply is a residual obtained from netting out "home consumption" from Gross Output. It identifies the marketed production and is subject to marketing margins.

**Home consumption ("*activities-households*"): 685**— Home consumption estimated from CSO 1996a: Table 1.5 is valued at more than half of the communal farms total production.

**Intermediate input ("*commodities-activities*"): 20,746**— Total intermediate input demand is from CSO 1998a: Table 7.3 and is assumed to be inclusive of imports, import tariffs and marketing margins.

**Marketing margins ("*commodities-commodities*"): 6,120**— The marketing margins represent the trade and transport margins associated with marketing domestic and imported goods. The total amount attributed to marketing margins is estimated as the residual of the trade and transport activity production less intermediate and final demand for this sector. Consequently this value is computed when the micro SAM is generated.

**Private consumption ("*commodities-household*"): 19,478**— It is consumption plus consumption of private non-profit bodies (CSO 1998a Table 3.1(a)) less home consumption.

**Government expenditures on goods and services ("*commodities-government*"): 4,775**— This is total general government final consumption expenditure (CSO 1998a Table 3.1(a)).

**Gross capital formation ("*commodities-capital*"): 5,658**— This is gross fixed capital formation (Z$6,098 millions) plus changes in stocks (- Z$439 million).

**Value added ("*factors-activity"*): 26,284**— Total value added is the sum of the primary factors of production, namely labor, capital and land. It is GDP at f.c in Table 1 [2].

**Factor income distributed to enterprises ("*enterprises-factors*"): 15,045**— Factor income distributed to Enterprises is the non labor value added of GDP at f.c. In Table 1,

[2] The 1997 National Accounts include adjustments to the series from 1985 to 1996 to account for the informal activities in the economy. Consequently, GDP f.c. is inclusive of these activities (CSO 1997: p.2).

it is equivalent to the value of rent income plus gross operating profit less imputed banking charges (CSO 1998a: Table 2.5)[3].

**Factor income distributed to households (*"households-factors"*): 11,213**— This represents the Wages and Salaries item in the CSO 1998a: Table 2.5 less Compensation to Employees paid to the rest of the world (CSO 1998a: Table 6.1).

**Factor income paid to the ROW ("*world-factors*"): 26**— It is the Compensation to Employees paid to the rest of the world listed (CSO 1998a: Table 6.1).

**Enterprises' retained earnings distributed to household ("*household-enterprises*"): 13,375**— This is the value of non labor income accruing to enterprises, augmented by government transfers to enterprises and less the sum of corporate saving, corporate tax, and property and entrepreneurial income paid to the rest of the world.

**Capital income paid to the world ("*world-enterprises*"): 535**— It is the property and entrepreneurial income paid to the rest of the world by corporate and quasi-corporate enterprises net of income received by these same institutions from the rest of the world (CSO 1998a: Table 6.1).

**Imports ("*world-commodities*"): 8,048**— Total imports of goods and services (CSO 1998a: Table 6.1).

**Exports ("*commodities-world*"): 7,075** Total exports of goods and services (CSO 1998a: Table 3.1(a)).

**Domestic indirect taxes("*government-activities*"): 1,478**—Total indirect taxes (Z$3,339 million) include domestic taxes on goods and services and import tariffs. This cell entry is the domestic tax on production. It is a residual from netting out import tariffs and subsidies from total indirect taxes (CSO 1998a: Table 7.9(a)).

**Import tariffs ("*government-commodities*"): 1,861**— These are the taxes on international trade and transaction (CSO 1998a: Tables 7.9(b) and 7.9(d)). This figure implies an average rate of 23 percent which is consistent with the tariff collection rates recorded by the World Bank (World Bank 1995).

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[3] The distribution between enterprises and households will change during the micro SAM generation. We assume that most of the informal activities' value added are labor value added instead of capital and they accrue directly to households.

**Corporate tax ("*government-enterprises*"): 1,667**— Taxes paid by enterprises (CSO 1998a: Tables 7.9(b) and 7.10(a)). They include corporate income tax, other unallocable income tax, and tax on property.

**Income tax ("*government-households*"): 2,060**— It is the individual income tax in CSO 1998a: Tables 7.9(b) and 7.10(a).

**Corporate saving ("*capital-enterprises*"): 908**— Enterprises saving is gross saving of public corporations and private financial institutions (CSO 1998a: Table 7.6).

**Household saving ("*capital-households*"): 3,695**— This entry is the residual of gross saving less corporate saving and government saving (which in the SAM is the government budget deficit, a negative entry).

**Government saving ("*capital-government*"): -504**— This represents the government budget deficit (negative saving) estimated at around 7 percent of government current expenditures. It is the balance in the government account between current expenditures (including net lending) and current revenue (including grants). This figure does not represent total budget deficit because capital expenditures by the government are not included in the government account. They are included in the capital account.

**Foreign saving ("*capital-world*"): 1,559**— Foreign saving is the surplus (in this case a deficit) of the nation on current transactions (CS0 1998a: Table 6.1) or the current account deficit (Table 1).

**Inter-household transfers ("*household-household*"): 259** — From the literature (Muir 1994 and Masters 1994), it is clear that smallholder households receive a large share of their total income from family members working in the urban areas. This is an attempt to quantify this transfer of income but there is no data to estimate its monetary value. The ICES estimates that SH households receive 26 percent of their cash income in transfer and gift (CSO 1994: Table 3.3(a)). This value is obtained during the micro SAM generation.

**Government transfers to enterprises ("*enterprises-government*"): 1,209**— This is interest payments paid by the government to domestic enterprises and subsidies to parastatals (Z$1,473 million) net of administrative fees and charges (Z$285 million) less the property and entrepreneurial income paid by the government to the rest of the world(Z$418 million) plus transfers and subsidies to non profit institutions (Z$439 million

or 77 percent of total transfers to non profit institutions)[4]. Computations are based on CSO 1998a: Tables 7.9(b) and 7.10(a).

**Government transfers to households ("*households-government*"): 1,459**— This is lending minus repayment (Z$1,335 million) plus 22 percent of transfers to non-profit institutions (Z$124 million). Computations are based on CSO 1998a: Tables 7.9(b) and 7.10(a).

**Transfers to rest of the world ("*world-government*"): 418**— This is property and entrepreneurial income paid by the general government to the rest of the world (CSO 1998a: Tables 7.9(b) and 7.10(a)). Income transfers from factors, enterprises, and government to the rest of the world sum up to the Net Factor Income paid abroad item in the balance sheet of Table 1.

**Remittances from abroad ("*households-world*"): 102**— It is the net current transfers from the rest of the world (CSO 1998a: Table 6.1) less foreign grants received by the government ((CSO 1998a: Tables 7.9(b) and 7.10(a)).

**Foreign grants ("*government-world*"): 291**— Foreign grants received by the government (CSO 1998a: Table 7.9(b)).

## 3. Estimating the micro SAM

As mentioned earlier, there is no previous Zimbabwe SAM with the level of disaggregation required for the purpose of this study (particularly in the agriculture sector). The last disaggregated I/O table for the country is for 1980 and does not include agriculture input structure and value added. Consequently, the Zimbabwe micro SAM is built from scratch from various data sources. The resulting 88 by 88 matrix results from estimating distribution patterns in production, consumption and income primarily based on official statistics and on the entropy estimations when the reliability or consistency of data fails.

### 3.1. Sectoral structure of the micro SAM

The structure of micro SAM is a disaggregated version of the macro SAM (Table 4). The selection of the micro SAM account structure arises from the focus of the study,

[4] The relative shares of transfers distribution between enterprises (77%) and households (22%) is from IMF 1997, p. 62.

Table 4 — Macro and micro SAM disaggregation

| Macro SAM Accounts | | Sectors | Micro SAM *Commodities* | Micro SAM *Activities* |
|---|---|---|---|---|
| *Activities /Commodities* | 1 | Maize | CMZ | AMZLC<br>AMZSH |
| | 2 | Wheat | CWT | AWT |
| | 3 | Other grain | COGRN | AOGRNLC<br>AOGRNSH |
| | 4 | Horticulture | CHORT | AHORTLC<br>AHORTSH |
| | 5 | Coffee | CCOF | ACOF |
| | 6 | Tea | CTEA | ATEA |
| | 7 | Groundnuts | CGRNT | AGRNTLC<br>AGRNTSH |
| | 8 | Cotton | CCOT | ACOTLC<br>ACOTSH |
| | 9 | Sugar | CSUG | ASUG |
| | 10 | Tobacco | CTOB | ATOB |
| | 11 | Other crops | COCRP | AOCRPLC<br>AOCRPSH |
| | 12 | Cattle | CCAT | ACATLC<br>ACATSH |
| | 13 | Other livestock | COLVK | AOLVKLC<br>AOLVKSH |
| | 14 | Fishery | CFISH | AFISH |
| | 15 | Forestry | CFOR | AFORLC<br>AFORSH |
| | 16 | Mining | CMIN | AMIN |
| | 17 | Grain milling | CGRM | AGRM |
| | 18 | Other food processing | COFDP | AOFDP |
| | 19 | Textiles | CTEXT | ATEXT |
| | 20 | Other light manufacturing | COLGT | AOLGT |
| | 21 | Fertilizer & agr. chemicals | CFERT | AFERT |
| | 22 | Other manufacturing | COMAN | AOMAN |
| | 23 | Electricity and water | CELWA | AELWA |
| | 24 | Construction | CCONS | ACONS |
| | 25 | Trade & transport | CTDTP<br>CTDTP-E<br>CTDTP-M<br>CTDTP-D | ATDTP |
| | 26 | Public services | CPUB | APUB |
| | 27 | Private services | CPRIV | APRIV |

Table 4— Cont'd

| Macro SAM Accounts | | Sectors | Micro SAM *Accounts* |
|---|---|---|---|
| *Factors* | 28 | LSC-unskilled workers | LABUSKLS |
| | 29 | Unskilled labor - formal | LABUSKF |
| | 30 | Unskilled labor-SH/ informal | LABUSKIF |
| | 31 | Skilled labor | LABSK |
| | 32 | Capital - LC | CAPLS |
| | 33 | Capital - SH | CAPSH |
| | 34 | Capital - Other | CAPOT |
| | 35 | Land -LC | LANDLS |
| | 36 | Land - SH | LANDSH |
| *Enterprises* | 37 | Enterprise | ENT |
| *Household* | 38 | LSC owner/manager hh | HLSUPP |
| | 39 | LSC farm worker hh | HLSLOW |
| | 40 | Small holder hh | HSHHLD |
| | 41 | URBAN-high income hh | HURBUPP |
| | 42 | URBAN-low income hh | HURBLOW |
| *Government* | 43 | Government | GOV |
| | | Direct taxes | DTAX |
| | | Indirect taxes | ATAX |
| | | Import taxes | IMPTAR |
| *Capital* | 46 | Saving & investment | SAVINV |
| *World* | 47 | Rest of the world | WORLD |

namely production and marketing of agricultural crops, income and consumption patterns of various population groups and from the availability of data on these sectors. Consequently the disaggregation occurs mainly in the activity, commodity, factors, and households accounts. The outcome is an 88 by 88 matrix which includes 36 activities, 27 commodities [5], 9 primary factors of production (4 labor categories, 3 capital and 2 land), one enterprise account, 5 households groups, a government account [6], an investment/saving account, and a foreign sector.

### 3.2. Disaggregation and documentation of data entries in the micro SAM

The table on the production account (CSO 1998a: Table 7.3) provides the output, intermediate consumption, and value added for 14 sectors. These sectors do not correspond to the classification of the micro SAM but provide a first level of disaggregation (aggregation). For example the first sector in the national account, labeled "Agriculture, hunting and fishing" is disaggregated into 15 agriculture commodities, while the manufacturing sector is disaggregated into 6 manufacturing commodity groups. On the other hand, sectors 6 through 14 are aggregated into three commodity groups, namely trade and transport, public services and private services.

To begin the process, the manufacturing sector is disaggregated into grain milling, food processing, textile, other light manufacturing, fertilizer [7], and other manufacturing using the Census of Industrial Production 1993/94 Report (CSO, 1995). Then the sectors of finance and insurance, real estate, hotel and restaurant, public administration, education, health, domestic services and other services are aggregated into public services and private services [8]. Finally the trade and transport is obtained by summing distribution, transports and communications. Table 5 summarizes the results of the above computations.

***Activity/commodity***

There are 15 sectors in agriculture (Table 4), and the production of small holder farms and that of large scale farms is distinguished, namely, for maize, other grains,

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[5] Three accounts are created in relation to the trade and transport sector to separate the marketing margins for exports (CTDTP-E), imports (CTDTP-M) and domestic goods (CTDTP-D).

[6] Three tax accounts are created to distinguish between import tariffs (IMPTAR), direct income taxes (DIRTAX), and indirect taxes (INDTAX). The income generated by these accounts are routed to the government.

[7] The fertilizer sector includes agricultural chemicals such as pesticides.

[8] The relative shares in ownership derived from CSO 1998: Table 7.4 are used to aggregate the 8 sectors into public and private activities.

horticulture, groundnuts, cotton, other crops, cattle, other livestock and forestry [9] . Small holders also produce wheat, tobacco, and coffee but the production was judged relatively too small (less than 1%) to warrant the distinction. Details on output of crops, livestock, fishery and forestry as well as the value of intermediate inputs used in the production process are derived from the production account of agriculture (CSO 1996a and 1996b). First the commodities listed in each of these documents are aggregated to reconcile with the classification specific to the micro SAM (Appendix Table 9); second, each input commodity is distributed among the output commodity groups previously defined, according to their relative share of production (unless the input is specific to the production of a sector). This first estimation is adjusted by information from Masters (1994: Table B.6) in the case of fertilizer use, for example. Once completed, the matrix obtained is scaled to reconcile with the aggregate value of agriculture gross output, and intermediate demand from Table 5: Agriculture and forestry.

The value added to each agriculture commodity is a residual obtained by netting out intermediate demand (generated by the intermediate input matrix) from gross output.

The non-agriculture sectors in the micro SAM include mining, six manufacturing sectors, electricity and water, construction and 3 service sectors (Table 4). The matrix of intermediate demand is derived from the 1980 I/O table (CSO 1988). The 1980 coefficients which are computed to include domestic flows, imports (including import tariff [10]), and transport and distribution margins are applied to the intermediate demand by industry shown in Table 5.

### *Value added*

In the micro SAM nine factor categories are identified: four labor groups, three capital categories, and two land categories.

- We identify six labor categories in Zimbabwe: (1) unskilled labor in LSC farms; (2) smallholder farm labor; (3) unskilled informal labor in nonagricultural sectors; (4) unskilled formal labor in nonagricultural sectors; (5) skilled labor in LSC farms (including management); and (6) skilled labor and management in nonagricultural sectors. In the SAM, these categories are integrated into four labor markets: LABSK includes both agricultural and nonagricultural skilled workers; LABUSKLS includes the large scale farm

[9] Most of small holder production of wood is for self use.

[10] The import tariff matrix is constructed by applying the tariff rates to the corresponding imported intermediate inputs.

Table 5 — Domestic Product by Industry, 1991 (Z$ million)

| Sectors | Production | Intermediate demand | Value Added |
|---|---|---|---|
| Agriculture and forestry | 6,385 | 2,372 | 4,013 |
| Mining and quarrying | 1,931 | 747 | 1,184 |
| Grain milling | 453 | 304 | 149 |
| Other food processing | 3,792 | 1,986 | 1,806 |
| Textile | 1,736 | 951 | 785 |
| Other light manufacturing | 2,928 | 1,361 | 1,567 |
| Fertilizer | 451 | 322 | 129 |
| Other manufacturing | 6,043 | 3,341 | 2,702 |
| Electricity and water | 1,011 | 311 | 700 |
| Construction | 3,025 | 2,212 | 813 |
| Trade and transport | 8,074 | 3,678 | 4,396 |
| Public services | 4,661 | 966 | 3,695 |
| Private services | 6,539 | 2,194 | 4,345 |
| Total | 47,029 | 20,745 | 26,284 |

Source: Based on data from the 1998 NA (CSO 1998a) and the Census of Industrial Production (CSO 1995).

unskilled workers [11], LABUSKIF includes the smallholder farmers and the nonagriculture informal labor, and finally LABUSKF is the formal unskilled labor in the urban areas [12].

- There are three capital factor categories[13] distinguished by activity: the LSC-farm capital (CAPLSC), the SH-farm capital (CAPSH), and the non-agriculture capital (CAPOT).

- Finally, there are two land value added [14]: LANDLS for LSC-farm production and LANDSH for SH-farm production.

In the 1997 NA (CSO 1997), factor income attributed Z$13,495 million and Z$12,789 million to labor and non-labor income respectively. The 1998 NA (CSO 1998a), on the other hand, attributes more of factor income to non-labor income Z$15,046 million while attributing only Z$ 11,238 to labor income. The difference is very close to the estimated value added generated by informal activities [15] and it seems that in the 1997 NA, informal activities augmented formal labor while in the 1998 NA they augmented capital value added. In the micro SAM, the informal valued added is mostly attributed to labor.

First, the value added is distributed among the primary factors of production:

- Table 6 summarizes the calibrations to separate the value of agriculture labor among the LSC farms and the SH farms and how they are reconciled with the NA aggregates on labor and capital. The labor in SH farms is attributed to the agricultural LABUSKIF; labor value added in LSC production is split between LSC unskilled workers (LABUSKLS) and skilled workers (LABSK). Within each factor category, the distribution across activities is according to the relative share in production [16].

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[11] The unskilled labor group in the LSC farm sector is landless and, for historical and institutional reasons, isolated. We assume no mobility across sectors (Masters 1994: pp. 9-10).

[12] Smallholder-farm and informal nonagricultural workers are linked to the formal, non-agricultural unskilled-labor market. The scarcity of formal-sector jobs forces many unskilled laborers to work in the lower-paying informal non-farm sector and smallholder farms.

[13] In the model, there is capital mobility within but not across the three capital groups.

[14] Land is considered a factor in the production of crops only.

[15] The revisions of the National Accounts of Zimbabwe include the informal sector (CSO, 1997 p.2) and estimates it to be 8.7 percent of the 1995 GDP f.c. This yields Z$ 2,286 millions for 1991.

[16] This is a first approximation which is later adjusted during the entropy process.

Table 6 — Distribution of value added, 1991 (Z$ million)

| Category | Value Added |
|---|---|
| GDP f.c. | 26,284 |
| Agriculture V.A. | 4,013 |
| Non-agriculture V.A. (26,284 less 4,013) | 22,271 |
| LSC farm V.A. | 2,918 |
| LSC farm wages and salary | 847 |
| LSC farm non-labor V.A. | 2,071 |
| SH farm V.A. (4,013 less 2,918) | 1,095 |

Source: Authors' calculations based on the 1998 NA (CSO 1998a) and the production accounts of agriculture (CSO 1996a and 1996b).

- Land value added is derived from estimates by Masters (1994: Appendix B) as a share of the value of output for crops grown in SH farms (LANDSH) and LSC farms (LANDLC).

- Capital is a residual which follows from Table 6 and net of land value added. It is distributed among the three types of production groups accordingly: smallholder farm capital (CAPSH), large scale commercial farm capital (CAPLSC) and non-agriculture capital (CAPOT).

- For non-agricultural activities, labor is distributed according to employment earnings (CSO 1998a: Table 7.7) and within manufacturing according to wages and salaries by ISIC code as given by the Census of Industrial Production. Formal labor is distributed 60 and 40 percent between the skilled (LABSK) and unskilled labor (LABUSKF) categories respectively.

- The informal value added accrues mostly to the unskilled informal labor (LABUSKIF) according to the distribution in the revised NA (CSO 1997: p.2) which allocates 19 percent to *agriculture*, 19 percent to *manufacture*, 2 percent to *construction*, 2 percent to *transport and communication* and 58 percent to *private services* (56 percent of total informal activities is attributed to the

*distribution*[17], *restaurants and hotels* sectors). A small percentage is attributed to non-agriculture capital value added: CAPOT ( in *textile, other light manufacture* and *trade and transport*, the split is 86 percent for labor and 14 percent for capital; in *construction* the split is 95 percent for labor and 5 percent for capital and in *private services* 100 percent goes to labor).

***Income distribution***

- Factor income generated in agriculture is distributed directly to the corresponding producing rural households: Labor income, capital income and land income generated by the SH production, accrue to the SH households (HSHHLD); labor income from the skilled category, capital income and land generated in LSC production accrue to LSC upper-income households (HLSUPP), and labor income from the unskilled LSC workers accrues to the low-income LSC households (HLSLOW).

- In the non-agriculture sector, labor income from unskilled workers in the formal and informal sector [18] goes to the low-income urban households (HURBLOW) and that of skilled workers to high-income households (HURBUPP).

- Non-agriculture capital is paid to the enterprise account. Enterprises distribute their retained earnings to households. Retained earnings are computed as total enterprise income (in this case capital income plus transfer from the government) less corporate taxes, corporate saving and any factor payment to the *ROW*. Retained earnings are distributed to the two upper-income households. The allocation between the two groups derives from having the urban high-income household earn 30 percent of their total income from capital. The remaining is allocated to the LSC upper-income households.

- In addition to factor income, institutions receive income from other institutions in the form of transfers. Transfers between institutions are reproduced from the macro SAM exactly except in the case of households whose transfers from the government , other households and the ROW have to be distributed among the five household groups. Government transfers are distributed to households in reconciliation with information in the ICES (CSO 1994: Tables 3.1 and 3.3), which estimates the share of government transfers in rural households' cash

[17] The high share of informal activity in this sector is consistent with studies on micro and small scale enterprises (MSE) conducted by GEMINI (GEMINI 1991, p.11) which states that nearly 23 percent of MSE is in the trade sector.

[18] Informal activities are characterized in the GEMINI study as enterprises largely unregistered, requiring low initial capital and skill requirements and mostly supplied by those who would otherwise be unemployed. (GEMINI 1991).

income at 5 percent for LSC and 40 percent for SH. The balance from total government transfers is allocated to urban households to accommodate 2 percent of HURBUPP income coming from government transfers and the rest is transferred to the lower-income group. Transfers from urban households to SH households is assumed to be 26 percent of SH cash income (CSO 1994: Tables 3.1 and 3.3);

***Households expenditures***

Households are classified into five groups in the micro SAM. One rationale for this is derived from the household groups surveyed in ICES (CSO 1993). ICES was constructed around five groups: large scale commercial, smallholder, communal, resettlement and urban groups. The smallholder, communal (by far the largest group) and resettlement households were combined into the classification HSHHLD; the two other groups were further disaggregated into upper and lower income households.

- Consumption expenditures: in a first approximation, we assume similar consumption patterns for the three low-income groups based on the consumption schedules in the ICES (CSO 1993: Table 3.5a). Further adjustments are made to reconciled with NA aggregates on private consumption as well as the constraints from the households' total income.

- Own-consumption: the consumption schedule for own-consumption by smallholder households (HSHHLD) is based on the production accounts for communal farmers.

- Income taxes: household income tax rates are derived from ICES. They range from 4 percent for HSHHLD to 17 percent for HURBUPP. The HLSLOW households are assumed to pay no taxes because of their low per capita income.

- Saving: household saving rates are derived from ICES by computing the share of income left after consumption expenditures are removed from total income (cash and in-kind). They ranged from 2 percent for HLSLOW to 16 percent for HURBUPP.

***Imports and exports***

The trade flows are derived from the Quarterly Digest of Statistitics (CSO 1998b). The commodities trade is from Tables 10.4 and 10.5 and the trade flows of private services are derived from Table 9.0 (Balance of Payments). Adjustments are made to reconcile with NA aggregates on Imports and Exports. The import tariff for commodities is based on the average MFN tariff and surcharge for the corresponding group (GATT 1995: Table AV.1). The tariffs range from 24 percent (agriculture) to 44 percent (manufactures).

***Investment expenditures***

Investment expenditures and change in stocks are based on gross capital formation by type of assets from CSO 1998a: Table 4.1(a). They are mainly directed at manufactures and construction.

***Government budget***

The government budget (central and local) is derived from CSO 1998a: Tables 7.9(b), 7.9(d), 7.10 (a) and 7.10(b). Capital expenditures and income are left out of the government budget. They are assumed to be part of gross capital formation. The tables are summarized to generate a government budget along the lines of the micro SAM framework.

Income tax income is composed of individual income taxes paid by households and corporate taxes including tax on property paid by enterprises.

Other income includes indirect taxes (tariffs and indirect taxes on activities) and foreign grants from the ROW.

Consumption expenditures: the current expenditures on final demand (CSO 1998a Table 7.8) are aggregated into food processing (1 %), light manufacturing (2%), other manufacturing (4%), trade and transport (4 %) and private services (18 %). The largest share in expenditure is compensation to employees (78 %) which is attributed to the consumption of public services.

Transfers to other institutions: transfers to enterprises include interest payments on the domestic debt and subsidies to parastatals. Transfers to households include net lending. Finally, transfers to ROW are property and entrepreneurial income paid to ROW.

***External transactions***

Trade flows and transfers to and from the government have been already discussed. Other transfers to the ROW are factor incomes received from non-governmental enterprises. Current transfers net of grants to the government are in the form of remittances to households (assumed to be paid entirely to the LSC upper-income household group).

Finally, the foreign saving is the balance between external income and expenditures and reflects the current account deficit.

Appendix Table 10 details the data sources used in the derivation of the micro SAM.

### 3.3 Balancing the SAM using a cross-entropy approach

The process described in the previous section yields a complete but unbalanced micro SAM, although in the aggregate it is reconciled to the corresponding macro SAM cells. To balance the micro SAM, a cross-entropy approach is the appropriate tool. [19]

Briefly, the cross-entropy method is to find a new set of SAM coefficients which minimizes the entropy distance between prior coefficients from the unbalanced SAM and the new estimated coefficients, given prior knowledge about any part of the SAM. The entropy equations insure that the column and row totals balance and that the column coefficients are smaller and add up to one. Other constraints can be imposed. These constraints are the mathematical expression of prior knowledge and certainty about any part of the SAM derived from official data or best estimates ( e.g. entropy estimations of factor income are constrained not only by the equality between their row and column sums but by the fact that the summation of these new estimations over all factor categories must equal GDP f.c.). In the Zimbabwe case, prior knowledge and confidence, the national account aggregates are used as constraints to insure that the entropy estimations keep the balanced SAM within the boundaries of official statistics .

The macro SAM cell values are used first as the base for constructing the micro SAM and later constitute the major constraints imposed on the entropy. All the non-empty cells are used except for the ones which reflect the distribution of factor income to enterprises and households and consequently the resulting *enterprise* income distributed to households, namely, *capital income*, *labor income* and *retained earnings* (Table 2).

At the more disaggregated level the following sectoral constraints are used:

- The sectoral values on domestic production, intermediate demand and value added (Table 5).
- The distribution of value added between agriculture and non-agriculture and between LSC-farms and SH-farms agriculture (Table 6).

The GAMS code for the entropy equations is shown in Appendix Table 13. The completed and balanced SAM is presented in Appendix Table 11 and the resulting macro SAM in Appendix Table 12.

[19] For a more detailed discussion of the cross-entropy approach to SAM estimation see Robinson, Cattaneo, and El-Said (1998).

### 3.4 The structure of the Zimbabwe economy: a SAM perspective

Since the aggregate constraints imposed during the entropy process are the initial macro SAM cells, the macro SAM derived from the final balanced micro SAM 1991 is identical to the original one except for the factor income distribution between *enterprises* and *households* and subsequently in the corporate income distribution to *households*.

At the sectoral level, the assumptions and estimations made in the course of constructing a micro SAM as well as the entropy process have implications for the structure of the Zimbabwe economy, particularly with regard to agricultural production and household expenditures.

By African standards, the Zimbabwe economy is characterized by a diversified and highly industrialized production base. This is reflected in Table 7 which shows that *manufacturing* (grain milling, other food processing, textiles, other light manufacturing, fertilizers and other manufacturing) is the largest sector in the economy and contributes around 27 percent of GDP, followed by *trade and transport* and *private services* (nearly 17 percent). Agriculture contributes 15 percent, slightly higher than public services (14 percent).

While agriculture contributes only 15 percent of GDP, it contributes 42 percent of exports with *tobacco* as the main export (35 percent). The next largest export is *private services* (23 percent). The crops destined mostly for exports are *coffee* (73 percent of its output), *tea* (53 percent), *cotton* (43 percent) and *tobacco* (92 percent). In the non-agriculture sector, *mining* and *private services* exports amount to 44 percent and 24 percent of their respective production totals.

Most imports are in non-agriculture (especially, *manufacturing* which accounts for 93 percent of total imports) but are used in agriculture by large scale farmers. In agriculture, *wheat* imports account for 12 percent of supply and *other grains* for 30 percent. In manufacturing, *fertilizers* and *other manufacturing* imports account for nearly half of their domestic use, respectively.

***Agricultural production***

The Zimbabwe SAM focuses on two types of farming at the sectoral level:

1) The production in large-scale commercial farms (LSC) dominates the agriculture production and is highly diversified with most crops comprising between 3 and 5 percent of total LSC production (Table 8). LSC production is characterized by high-value crops such as *tobacco* (51 percent of total LSC production), intensive use of capital (34 percent of output) and inputs (42 percent).

Table 7 — The structure of the Zimbabwe economy (in percent)

| | Gross Output | GDP | Exports | Imports | Share of Exports | Share of imports |
|---|---|---|---|---|---|---|
| Maize | 1.10 | 1.54 | 1.04 | | 22.27 | |
| Wheat | 0.26 | 0.44 | | 0.21 | | 11.80 |
| Other grain | 0.20 | 0.26 | | 0.14 | | 30.34 |
| Horticulture | 0.61 | 0.64 | 0.23 | 0.06 | 7.24 | 2.09 |
| Coffee | 0.24 | 0.28 | 1.18 | | 72.91 | |
| Tea | 0.18 | 0.21 | 0.65 | | 52.88 | |
| Groundnuts | 0.23 | 0.30 | 0.13 | | 28.74 | |
| Cotton | 0.79 | 0.98 | 2.35 | | 43.31 | |
| Sugar | 0.54 | 0.63 | 1.45 | | 38.96 | |
| Tobacco | 5.49 | 6.60 | 34.52 | 0.19 | 91.70 | 0.58 |
| Other crops | 0.59 | 0.71 | | | | |
| Cattle | 1.72 | 1.37 | | | | |
| Other livestock | 1.39 | 1.01 | 0.35 | | 4.51 | |
| Fisheries | 0.12 | 0.08 | | | | |
| Forestry | 0.16 | 0.25 | | | | |
| Mining | 4.16 | 4.51 | 12.58 | 1.25 | 44.06 | 4.73 |
| Grain milling | 0.92 | 0.57 | | | | |
| Other food processing | 7.74 | 6.87 | 2.52 | 1.97 | 4.75 | 4.05 |
| Textiles | 3.71 | 2.99 | 1.71 | 3.69 | 6.70 | 14.13 |
| Other light manufacturing | 6.34 | 5.96 | 2.05 | 5.29 | 4.71 | 12.14 |
| Fertilizers | 0.98 | 0.49 | 0.13 | 4.02 | 1.97 | 40.49 |
| Other manufacturing | 12.95 | 10.28 | 16.53 | 77.61 | 18.61 | 49.85 |
| Electricity and water | 2.20 | 2.66 | | | | |
| Construction | 6.57 | 3.09 | | | | |
| Trade and transport | 17.04 | 16.73 | | | | |
| Public services | 10.03 | 14.06 | | | | |
| Private services | 13.74 | 16.53 | 22.59 | 5.60 | 23.98 | 6.33 |
| Total agriculture | 13.62 | 15.27 | 41.90 | 0.60 | | |
| Total non-agriculture | 86.39 | 84.73 | 58.10 | 99.4 | | |

Source: Based on data from the micro SAM, 1991

Table 8 — Structure of agriculture production ( in percent )

| | Share in total agriculture production | | Contribution to total marketed production | |
|---|---|---|---|---|
| | LSC | SH | LSC | SH |
| Maize | 4 | 27 | 60 | 40 |
| Wheat | 3 | | 100 | |
| Other grains | 0 | 6 | 82 | 18 |
| Horticulture | 3 | 6 | 95 | 5 |
| Coffee | 2 | | 100 | |
| Tea | 2 | | 100 | |
| Groundnuts | 0 | 6 | 61 | 39 |
| Cotton | 3 | 15 | 48 | 52 |
| Sugarcane | 5 | | 100 | |
| Tobacco | 51 | | 100 | |
| Other crops | 5 | 3 | 86 | 14 |
| Cattle | 9 | 26 | 64 | 36 |
| Other livestock | 10 | 9 | 99 | 1 |
| Fishery | 1 | | 100 | |
| Forestry | 1 | 2 | 99 | 1 |
| Total | 100 | 100 | | |
| ***Production technology*** | | | | |
| Intermediate input use | 42 | 18 | | |
| Labor | 15 | 52 | | |
| Capital | 34 | 20 | | |
| Land | 9 | 10 | | |

Source: Based on data from the micro SAM, 1991.

Note: SH's production of wheat, coffee and tobacco is negligible (less than 1% of total SH production) and no distinction is made between SH and LSC.

2) The small holder farms, mostly communal farms, are characterized by more labor intensive production (52 percent) and little use of inputs (18 percent). Their production is dominated by maize and cattle which together account for more than half of their production (Table 8). SH's production is mainly directed for home consumption as evidenced by its contribution to the marketed supply: although SH's maize production accounts for 63 percent of total maize production, it contributes only 40 percent of the marketed supply; in the same way, other grains (consisting mostly of small grains) produced by SH farms contribute only 18 percent of marketed supply. Cotton is an important crop for SH. The conditions for growing cotton (a drought-tolerant and labor intensive crop) make it an attractive crop for communal farms (World Bank 1991: p. 199). While cotton accounts for 15 percent of SH production (the second largest crop after maize) its contribution to marketed supply is more than half (52 percent).

***Household income***

The SAM distinguishes five household groups. The selection of three household groups in the rural area is suggested in part by the social and economic characteristics of the different farming systems and by the way the household survey data is organized. The two urban groups reflect mainly the difference in the source and level of income of the urban dwellers.

The five household types differ greatly in their income levels. Per capita income is estimated from the SAM and gives the following results: the poorest groups are the large scale commercial farm workers (HLSLOW) and communal households (HSHHLD) with per capita incomes of Z$257 and Z$312 respectively [20]. These estimates, which include the value of production for home consumption, are slightly above the poverty line for the rural area identified in the World Bank poverty assessment (World Bank 1995). The urban low income household (HURBLOW) group fares better with a per capita income of Z$1,267. The two wealthiest groups are the large scale commercial households (HLSUPP) and the urban high income (HURBUPP) with Z$11, 951 and Z$12,083 per capital, respectively.

The poorest groups derive their income mainly from wages (formal and informal) and transfers from other households and the government: communal households, for example, derived as much as 14 percent of their income from urban household transfers and 26 percent from government. [21] The workers in the large scale commercial farms are considered to be an isolated group with income deriving entirely from wages. The urban

[20] These estimates are based on the following population estimates: 774 thousand persons for HLSUPP, 387 thousand for HLSLOW, 5.856 million for HSHHLD, 1.026 million for HURBUPP, and 2.053 million for HURBLOW.

[21] As noted previously, part of the transfers are in the form of loans.

low income group receives income from wages (30 percent) and informal activities (61 percent). The large scale commercial farm upper income group derives most of its income from non labor earnings from the farms (24 percent) and investment in agro-business activities (60 percent). In the urban area, the most important source of income for the upper income group is wages (73 percent) followed by capital earnings of 37 percent.

***Household expenditures***

The household groups differ also by their consumption patterns. Lower income households consume between 48 and 63 percent of their consumption expenditures on food items and around 25 percent on light manufacturing. The higher income groups still consume more than 25 percent of their consumption expenditures on food but mostly processed food items. They also spend between 15 and 22 percent on manufactured items and close to 20 percent on private services.

## 4. Conclusion

Data gathered for the purpose of building the 1991 Zimbabwe SAM, is derived from various sources but mostly from the Zimbabwe Central Office of Statistics. The tables from the revised 1997 (and 1998) National Account are for the most part consistent with each other but cannot always be reconciled with information from other CSO documents such as the household (CSO 1994 )and industrial (CSO 1995) surveys. The discrepancies and gaps encountered during the disaggregation process results in some assumptions being made about the distribution of aggregate flows among the sectors; namely, the income and expenditure distribution among different household groups and the distribution of value added among the factors of production. The process of entropy, designed to balance the flows of income and expenditure at the sectoral level, yields another level of estimations.

In spite of these adjustments, the data information provided by the resulting SAM underscore a structure of the Zimbabwean economy which seems to reasonably reflect that of the base year. This is important as the Zimbabwe SAM, ultimately, serves as the data basis for models (CGE and multipliers) designed to measure the effects of policy reforms on economic growth and equity in the Zimbabwe context.

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Appendix Table 9 — Concordance List

| | The micro SAM Classification | Corresponding Sectors |
|---|---|---|
| 1 | Maize | Maize |
| 2 | Wheat | Wheat |
| 3 | Other grains | Sorghum, mhunga, barley, rice, rapoko, other |
| 4 | Horticulture | Dry beans, potatoes, onions, peas, tomatoes, other vegetables, flower and garden plants, citrus, deciduous, tropical, fruit trees, other fruit |
| 5 | Coffee | Coffee (green beans) |
| 6 | Tea | Tea (black) |
| 7 | Groundnuts | Groundnuts (shelled and unshelled) |
| 8 | Cotton | Cotton (unginned) |
| 9 | Sugar | Sugar (raw) & by products (bagasse) |
| 10 | Tobacco | Tobacco (non manufactured) |
| 11 | Other crops | Soya beans, seeds, fodder crops, other industrial crops |
| 12 | Cattle | Cattle |
| 13 | Other livestock | Other livestock & products |
| 14 | Fishery | Fishery |
| 15 | Forestry | Forestry |
| 16 | Mining | Chrome, copper & nickel inc. smelting, gold, iron ore & stone sand, asbestos, phosphates, other minerals nes |
| 17 | Grain milling | Grain milling and feed. |
| 18 | Other food processing | Slaughter, meat, meat production, canning and preserve of fruit and vegetable, bakery, cocoa, chocolate, foodstuff nes, sugar (milled and refined, animal & vegetable oils, beer, wine, spirits, soft drinks and carbonated water, misc. processed food products including processed seeds. |
| 19 | Textiles | Cotton ginning, spinning, weaving, finishing textiles, knitted products, rope and cordage, carpets and rugs, textiles nes. |
| 20 | Other light manufacturing | Wearing apparel and footwear, tobacco products including post auction packing & grading, sawmilling and wooden products, furniture and fixtures, pulp, paper, paperboard and their products, printing, publishing and allied ind. |
| 21 | Fertilizer & agricultural chemicals | Fertilizer, pesticides & insecticides, basic chemicals. |

Appendix Table 9. Cont'd

| | The micro SAM Classification | Corresponding Sectors |
|---|---|---|
| 22 | Other manufacturing | Paints, varnishes & filling material, Soaps, detergents, toilet prep. & pharmaceuticals, Matches, inks, candles, glues, polishes, and chemicals, petroleum products and gases, rubber and plastic products, nonmetallic mineral products, structural clay products including bricks, Glass, cement, and ass. products & other non-metalic mineral products, Non-ferrous metal and iron and steel inc. smelting, Metal products, machinery and non elec. equipment , Electrical machinery and equipment, radio & communication equip., Motor vehicles inc. reconditioning, Other vehicles and equipment including repairs, other manufacturing industries. |
| 23 | Electricity and water | Generation and distribution of electricity and water |
| 24 | Construction | Public building and civil engineering, private building and civil engineering. |
| 25 | Trade & transport | Distribution, transport and communication |
| 26 | Public services | Finance and insurance (17 %), hotels and restaurants (5%), agricultural services (100%), public administration (100%), education (92%), health (67%), other services (12%) |
| 27 | Private services | Finance and insurance (83 %), real estate (100 %) , hotels and restaurants (95%), education (8%), health (33%), domestic services (100%), other services (88%) |

Sources: The input-output statistics of Zimbabwe (CSO 1988), the production accounts of agriculture (CSO 1996a and 1996b) and the census of industrial production (CSO 1995).

Appendix Table 10 — Data sources for the micro SAM

| Source Documents | Data extracted | SAM Entries |
|---|---|---|
| **National Accounts 1985-1996 (CSO 1997)** | | |
| *Table 7.4 GDP by kind of activity and ownership* | • This is the breakdown between public and private activity by industry. It is used to aggregate services into public and private services. | • Control total for total value added for the service sectors |
| *Tables 7.7 Quarterly Employment Survey* | • Annual Earnings | • Annual earnings per sector provides the basis for formal labor value added by industry. When netted out of GDP f.c., the residual is non labor value added by industry (inclusive of land for the agriculture sector). |
| *Table 7.9(b) Revenue and Grants of Central Government*<br>*Table 7.9(d) Central Government Expenditures and Net Lending by Economic Group*<br>*Table 7.10(a) Local Government Revenue*<br>*Table 7.10(c) Expenditures and Net Lending by Economic Group - Local Government* | • Income tax revenue from individuals<br>• Corporate Income tax + Other unallocable + Tax on property<br>• Domestic tax on goods less subsidies<br>• Taxes -- International Trade and Transactions<br>• Grants from abroad<br>• Expenditure on Goods and Services<br>• Interest Payments and transfers to non Profit organizations<br>• Total lending minus repayment | • Total household income tax<br>• Enterprise income tax<br>• Total indirect tax on domestic production<br>• Total Import tariff<br>• Transfer from World to Government<br>• Government consumption expenditure<br>• Transfer from Government to Enterprise and World<br>• Transfer from Government to Households |
| **Production Account of Agriculture, Forestry and Fishing (CSO 1996b)** | | |
| *Table 2 Details of Output* | • Output of primary products | • Aggregated when appropriate into output for maize, wheat, other grains (shorghum, rice, mhunga, rapoko, barley and other), horticulture (sunflower, dry beans, potatoes, vegetables, garden plants, and fruit), coffee, tea, groundnuts, cotton, sugar, tobacco, other crops (seeds, fodder crops, soya beans), cattle , other livestock (dairy products, poultry, other livestock, game products), fishery, and forestry. |
| *Table 3 Details of Inputs* | • Direct for crops, livestock and fishery | • When the input is not linked to a specific commodity group, it is distributed among commodities according to their relative shares of production. |
| | • General such as Fuel, electricity and water | • Distributed among the agricultural commodities according to their relative shares of production. |

| Source Documents | Data extracted | SAM Entries |
|---|---|---|
| **Production Account of Agriculture: Communal Lands, Including Resettlement Areas (CSO 1996a)** | | |
| *Table 1.5 Production Account of Agriculture: Communal Lands Including Resettlement Areas* | • Sale of Crops<br>• Livestock<br>• Production for Own Consumption<br>• Inputs. | • Aggregated when appropriate into output for maize, wheat, other grains (shorghum), horticulture (sunflower), coffee, groundnuts, cotton, tobacco, other crops (soya beans, other).<br>• Aggregated into cattle , other livestock (dairy products, pigs, sheep, goats)<br>• Aggregated into maize, groundnuts, other grains, horticulture (beans, fruits and vegetables), other crops (other), cattle (meat), livestock (milk), forestry (firewood).<br>• When the input is not linked to a specific commodity group, it is distributed among commodities according to their relative shares of production. |
| **Census of Industrial Production 1993/94 Report (CSO 1995)** | | |
| *Table 2 Summary of operations by Industry* | • Gross output excluding sales of goods not produced on premises.<br>• Total Purchases excluding goods purchased for resale.<br>• Wages and salaries | • Gross output of goods aggregated into microsam sectors.<br>• Total intermediate demand by commodity aggregated into microsam sectors.<br>• Value added labor for these sectors used the three distributions of gross output, intermediate demand and value added to disaggregate the manufacturing sector item in the N.A. into the microsam's six manufacturing sectors. |
| *Table 4 Analysis of purchases and changes in stocks* | • Purchases of Electricity and water. | • Intermediate demand for electricity and water. |
| The Quarterly Digest of Statistics **(CSO 1997)** | | |
| *Table 10.4 Domestic Exports Classified by SITC Sections and Principal Commodities within Sections* | • Export distribution by SITC classification. | • Aggregated into the commodity classification of the microsam. The difference with the N.A. account is attributed to export of private services (tourism). |
| *Table 10.5 Domestic Imports Classified by SITC Sections and Principal Commodities within Sections* | • Import distribution by SITC classification. | • Aggregated into the commodity classification of the microsam. The difference with the N.A. account is attributed to import of private services. |

| Source Documents | Data extracted | SAM Entries |
|---|---|---|
| **Income Consumption and Expenditure Survey Report 1990/91 (CSO 1994)** | | |
| *Table 3.1(a) Average Annual Household Cash Income by type of Income and sector* | • The schedule of income sources and tax payments for LSC, SSC, Communal, Resettlement, and Urban households. | • Sources of income (wages, capital, transfer) and tax rate are identified for three household groups: large scale farms (LSC), small scale farms (SSC, communal and resettlement), and urban. |
| *Table 3.3(a) Average Annual Income In Kind by Type of Income and Sector* | • The schedule of income sources in kind for LSC, SSC, Communal, Resettlement, and Urban households.. | • This table is combined with Table 3.1(a) to estimate the share of non cash income (associated with informal activities) in total income. |
| Table 3.5(a) Average Annual Household Consumption Expenditure By Commodity Group and Sector | • The schedule of consumption expenditure for LSC, SSC, Communal, Resettlement, and Urban households. | • A schedule of consumption expenditure for the three household groups (large scale farms, small scale farms and urban is derived, then aggregated to reconcile as closely as possible with the microsam classification. |
| **The Input-Output Structure of the Economy of Zimbabwe 1980 (CSO 1988)** | | |
| *Table 2 Inputs and Final Demand Table for Zimbabwe*<br>*Table 3 Import Matrix (use of import)*<br>*Table 4 Transport Margins Table for Zimbabwe*<br>*Table 5 Distribution Margins Table for Zimbabwe* | • Input coefficients for the non-agriculture sectors<br>• The distribution of indirect taxes<br>• The marketing margins distribution per commodity. | • Intermediate input schedule for the non-agriculture sector.<br>• The distribution of indirect taxes<br>• Basis for marketing margins distribution, adjusted for agriculture and split between export, import and domestic marketing margins. |

Appendix Table 11 — 1991 Micro SAM: Input-Output table (in Z$ million)

| | AMZLC | AMZSH | AWT | AOGRNLC | AOGRNSH | AHORTLC | AHORTSH | ACOF | ATEA | AGRNTLC | AGRNTSH | ACOTLC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMZ | | | | | | | | | | | | |
| CWT | | | | | | | | | | | | |
| COGRN | | | | | | | | | | | | |
| CHORT | | | | | | | | | | | | |
| CCOF | | | | | | | | | | | | |
| CTEA | | | | | | | | | | | | |
| CGRNT | | | | | | | | | | | | |
| CCOT | | | | | | | | | | | | |
| CSUG | | | | | | | | | | | | |
| CTOB | | | | | | | | | | | | |
| COCRP | | | | | | | | | | | | |
| CCAT | | | | | | | | | | | | |
| COLVK | | | | | | | | | | | | |
| CFISH | | | | | | | | | | | | |
| CFOR | | | | | | | | 1.571 | 1.400 | | | 1.396 |
| CMIN | | | | | | | | | | | | |
| CGRMIL | | | | | | | | | | | | |
| COFDP | 3.629 | 4.364 | 4.134 | 0.532 | 1.837 | 2.728 | 5.587 | 3.885 | 3.036 | 0.622 | 9.968 | 4.441 |
| CTEXT | | | | | | | | | | | | |
| COLGT | 4.632 | 25.902 | 5.362 | 0.693 | 13.408 | 5.738 | | 0.277 | 0.210 | 0.045 | | 11.572 |
| CFERT | 45.018 | 49.769 | 30.655 | 2.967 | 0.428 | 40.004 | 5.035 | 10.912 | 8.249 | 1.738 | 0.585 | 24.181 |
| COMAN | 0.542 | | 0.461 | 0.054 | | 0.476 | | 0.309 | 0.235 | 0.049 | | 0.487 |
| CELWA | 2.936 | | 3.343 | 0.449 | | 2.223 | | 3.663 | 2.902 | 0.522 | | 4.130 |
| CCONS | | | | | | | | | | | | |
| CTDTP | 2.029 | 4.571 | 1.681 | 0.212 | 1.957 | 1.240 | 4.901 | 1.823 | 1.384 | 0.278 | 6.577 | 1.893 |
| CTDTP-E | | | | | | | | | | | | |
| CTDTP-M | | | | | | | | | | | | |
| CTDTP-D | | | | | | | | | | | | |
| CPUB | | 1.011 | | | | | | | | | | |
| CPRIV | 13.821 | 1.874 | 14.620 | 1.733 | 0.189 | 9.795 | 0.303 | 13.162 | 9.863 | 2.184 | 0.224 | 20.559 |
| LABUSKLS | 5.806 | | 4.857 | 0.551 | | 4.594 | | 3.107 | 2.344 | 0.509 | | 4.538 |
| LABUSKF | | | | | | | | | | | | |
| LABUSKIF | | 156.666 | | | 33.415 | | 37.074 | | | | 40.115 | |
| LABSK | 19.809 | | 16.452 | 1.789 | | 15.443 | | 15.331 | 10.957 | 1.689 | | 22.696 |
| CAPLSC | 83.663 | | 49.660 | 7.651 | | 65.519 | | 42.331 | 32.167 | 7.368 | | 61.662 |
| CAPSH | | 62.263 | | | 11.938 | | 12.341 | | | | 13.917 | |
| CAPOT | | | | | | | | | | | | |
| LANDLS | 28.150 | | 43.362 | 2.577 | | 21.520 | | 11.483 | 8.725 | 2.080 | | 16.748 |
| LANDSH | | 47.910 | | | 9.108 | | 11.192 | | | | 12.431 | |
| ENT | | | | | | | | | | | | |
| HLSUPP | | | | | | | | | | | | |
| HLSLOW | | | | | | | | | | | | |
| HSHHLD | | | | | | | | | | | | |
| HURBUPP | | | | | | | | | | | | |
| HURBLOW | | | | | | | | | | | | |
| GOV | | | | | | | | | | | | |
| DTAX | | | | | | | | | | | | |
| TAX | (12.229) | (18.273) | (50.053) | 1.594 | 4.886 | 43.531 | 7.368 | 6.699 | 5.086 | 1.789 | 6.474 | 9.582 |
| MPTAR | | | | | | | | | | | | |
| SAVINV | | | | | | | | | | | | |
| DSTOCK | | | | | | | | | | | | |
| ROW | | | | | | | | | | | | |
| TOTAL | 197.804 | 336.057 | 124.535 | 20.804 | 77.164 | 212.813 | 83.800 | 114.552 | 86.560 | 18.874 | 90.291 | 183.886 |

Appendix Table 11 — cont'd: Input-Output table

| | ACOTSH | ASUG | ATOB | AOCRPLC | AOCRPSH | ACATLC | ACATSH | AOLVKLC | AOLVKSH | AFISH | AFORLC | AFORSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMZ | | | | | | | | | | | | |
| CWT | | | | | | | | | | | | |
| COGRN | | | | | | | | | | | | |
| CHORT | | | | | | | | | | | | |
| CCOF | | | | | | | | | | | | |
| CTEA | | | | | | | | | | | | |
| CGRNT | | | | | | | | | | | | |
| CCOT | | | | | | | | | | | | |
| CSUG | | | | | | | | | | | | |
| CTOB | | | | | | | | | | | | |
| COCRP | | | | | | 40.308 | 5.049 | 49.295 | 1.489 | | | |
| CCAT | | | | | | 81.038 | | | | | | |
| COLVK | | | | | | | | 64.382 | | | | |
| CFISH | | | | | | | | | | | | |
| CFOR | | 1.936 | | | | 1.346 | | 1.223 | | | | |
| CMIN | | | | | | | | | | | | |
| CGRMIL | | | | | | | | | | | | |
| COFDP | 1.095 | 9.301 | 39.936 | 8.703 | 2.680 | 144.140 | 4.425 | 171.103 | 1.372 | 9.957 | | |
| CTEXT | | | | | | | | | | | | |
| COLGT | 0.731 | 0.636 | 8.220 | 0.591 | | | | | | | | |
| CFERT | 35.231 | 25.225 | 345.106 | 23.536 | 2.399 | 60.666 | | | | | | |
| COMAN | | 0.723 | 6.912 | 0.675 | | 29.864 | | 36.379 | | | 5.646 | |
| CELWA | | 8.425 | 17.963 | 6.826 | | 10.604 | | 12.084 | | | | |
| CCONS | | | | | | | | | | | | |
| CTDTP | 1.646 | 4.224 | 18.929 | 3.840 | 2.352 | | 7.036 | | | | | |
| CTDTP-E | | | | | | | | | | | | |
| CTDTP-M | | | | | | | | | | | | |
| CTDTP-D | | | | | | | | | | | | |
| CPUB | | | 5.516 | | | | | | | | | |
| CPRIV | 1.057 | 33.004 | 434.179 | 29.692 | 0.144 | 22.223 | 25.263 | 28.500 | | | | |
| LABUSKLS | | 6.953 | 47.559 | 6.651 | | 3.025 | | 6.791 | | 0.916 | 1.473 | |
| LABUSKF | | | | | | | | | | | | |
| LABUSKIF | 79.059 | | | | 17.553 | | 216.606 | | 74.392 | | | 29.312 |
| LABSK | | 35.462 | 440.242 | 22.933 | | 12.207 | | 33.887 | | 2.870 | 3.910 | |
| CAPLSC | | 97.087 | 982.019 | 96.875 | | 38.604 | | 109.285 | | 15.964 | 29.216 | |
| CAPSH | 21.609 | | | | 5.684 | | 88.754 | | 40.674 | | | 2.868 |
| CAPOT | | | | | | | | | | | | |
| LANDLS | | 26.328 | 264.813 | 31.745 | | | | | | | | |
| LANDSH | 50.391 | | | | 5.771 | | | | | | | |
| ENT | | | | | | | | | | | | |
| HLSUPP | | | | | | | | | | | | |
| HLSLOW | | | | | | | | | | | | |
| HSHHLD | | | | | | | | | | | | |
| HURBUPP | | | | | | | | | | | | |
| HURBLOW | | | | | | | | | | | | |
| GOV | | | | | | | | | | | | |
| DTAX | | | | | | | | | | | | |
| TAX | 9.729 | 14.431 | 51.995 | 13.644 | 3.167 | 22.401 | 20.328 | 33.584 | 7.527 | 29.981 | 4.119 | 2.137 |
| IMPTAR | | | | | | | | | | | | |
| SAVINV | | | | | | | | | | | | |
| DSTOCK | | | | | | | | | | | | |
| ROW | | | | | | | | | | | | |
| TOTAL | 200.549 | 263.735 | 2,663.388 | 245.711 | 39.749 | 466.426 | 367.461 | 546.514 | 125.454 | 59.689 | 44.364 | 34.317 |

Appendix Table 11 — cont'd: Input-Output table

| | AMIN | AGRMIL | AOFDP | ATEXT | AOLGT | AFERT | AOMAN | AELWA | ACONS | ATDTP | APUB | APRIV |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMZ | | 57.693 | 15.130 | | | | | | | | | |
| CWT | | 150.165 | 19.378 | | | | | | | | | |
| COGRN | | | | | | | | | | | | |
| CHORT | | 3.761 | | | | | | | | | | |
| CCOF | | | 54.186 | | | | | | | | | |
| CTEA | | | 58.267 | | | | | | | | | |
| CGRNT | | 5.599 | 9.728 | | | | 6.508 | | | | 3.928 | 2.494 |
| CCOT | | 2.444 | | 282.212 | | | | | | | | |
| CSUG | | 1.308 | 210.465 | | | | | | | | | |
| CTOB | | | | | 849.988 | | | | | | | |
| COCRP | | 13.611 | 54.967 | | | | 66.327 | | | | 24.617 | 22.645 |
| CCAT | | 1.855 | 530.841 | | 12.396 | | 40.713 | | | | 10.943 | 22.806 |
| COLVK | | 1.586 | 224.164 | | 7.253 | | 16.220 | | | | 9.850 | |
| CFISH | | | | | | | | | | | | |
| CFOR | | | | | | | | | | | | |
| CMIN | 92.012 | 1.873 | 37.581 | 12.668 | 12.356 | 38.918 | 905.706 | 40.827 | 270.254 | 84.680 | 11.724 | 21.789 |
| CGRMIL | | 5.231 | 20.310 | | 1.422 | | | | | | 3.917 | |
| COFDP | | 16.420 | 223.650 | 4.464 | 5.244 | 1.325 | 27.448 | | | 32.629 | 36.191 | 83.473 |
| CTEXT | 15.787 | 8.305 | 68.673 | 509.853 | 190.949 | 1.335 | 66.531 | 2.853 | 26.739 | 185.439 | 186.177 | 127.269 |
| COLGT | 16.260 | 2.798 | 60.174 | 16.270 | 140.933 | 3.205 | 54.448 | 6.279 | 17.373 | 115.206 | 35.094 | 110.904 |
| CFERT | 19.163 | 1.902 | 4.368 | 23.809 | 3.339 | 176.500 | 20.585 | 7.049 | 3.407 | 7.863 | 2.726 | |
| COMAN | 527.548 | 14.659 | 293.611 | 51.813 | 92.303 | 44.651 | 2,022.752 | 42.255 | 1,548.602 | 2,648.697 | 483.929 | 550.250 |
| CELWA | 47.655 | 3.291 | 13.449 | 15.521 | 7.464 | 38.064 | 14.242 | 186.655 | 10.147 | 14.819 | 8.705 | 10.845 |
| CCONS | | 1.058 | 8.155 | | 5.142 | 1.239 | 12.634 | | 109.810 | 96.710 | 34.868 | 131.328 |
| CTDTP | 22.327 | 6.291 | 43.630 | 23.942 | 20.871 | 9.643 | 49.256 | 21.991 | 56.105 | 182.636 | 35.773 | 167.899 |
| CTDTP-E | | | | | | | | | | | | |
| CTDTP-M | | | | | | | | | | | | |
| CTDTP-D | | | | | | | | | | | | |
| CPUB | | 1.049 | 7.975 | 4.432 | 5.086 | 1.231 | 12.383 | | 160.411 | 278.453 | 64.396 | 917.260 |
| CPRIV | 6.247 | 3.519 | 27.616 | 6.018 | 6.645 | 5.470 | 25.542 | 3.092 | 9.152 | 30.870 | 12.667 | 25.529 |
| LABUSKLS | | | | | | | | | | | | |
| LABUSKF | 35.565 | 5.985 | 23.833 | 26.686 | 52.979 | 6.180 | 76.422 | 24.788 | 51.159 | 129.132 | 205.837 | 113.727 |
| LABUSKIF | | | | 106.130 | 252.141 | | | | 53.739 | 503.413 | | 577.891 |
| LABSK | 327.036 | 45.582 | 200.872 | 234.437 | 528.899 | 47.053 | 965.888 | 217.756 | 513.037 | 1,814.440 | 2,591.149 | 1,679.413 |
| CAPLSC | | | | | | | | | | | | |
| CAPSH | | | | | | | | | | | | |
| CAPOT | 821.400 | 97.249 | 1,581.316 | 417.892 | 733.119 | 75.616 | 1,659.721 | 457.456 | 195.065 | 1,949.681 | 897.681 | 1,973.636 |
| LANDLS | | | | | | | | | | | | |
| LANDSH | | | | | | | | | | | | |
| ENT | | | | | | | | | | | | |
| HLSUPP | | | | | | | | | | | | |
| HLSLOW | | | | | | | | | | | | |
| HSHHLD | | | | | | | | | | | | |
| HURBUPP | | | | | | | | | | | | |
| HURBLOW | | | | | | | | | | | | |
| GOV | | | | | | | | | | | | |
| DTAX | | | | | | | | | | | | |
| TAX | 88.876 | (8.029) | (36.197) | 65.549 | 148.650 | 25.145 | 240.353 | 58.277 | 159.646 | 188.471 | 203.298 | 124.461 |
| IMPTAR | | | | | | | | | | | | |
| SAVINV | | | | | | | | | | | | |
| DSTOCK | | | | | | | | | | | | |
| ROW | | | | | | | | | | | | |
| TOTAL | 2,019.876 | 445.203 | 3,756.142 | 1,801.696 | 3,077.177 | 475.574 | 6,283.679 | 1,069.277 | 3,184.646 | 8,263.137 | 4,863.472 | 6,663.621 |

Appendix Table 11 — cont'd: Absorption table

| | CMZ | CWT | COGRN | CHORT | CCOF | CTEA | CGRNT | CCOT | CSUG | CTOB | COCRP | CCAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AMZLC | 197.804 | | | | | | | | | | | |
| AMZSH | 131.903 | | | | | | | | | | | |
| AWT | | 124.535 | | | | | | | | | | |
| AOGRNLC | | | 20.804 | | | | | | | | | |
| AOGRNSH | | | 4.492 | | | | | | | | | |
| AHORTLC | | | | 212.813 | | | | | | | | |
| AHORTSH | | | | 10.870 | | | | | | | | |
| ACOF | | | | | 114.552 | | | | | | | |
| ATEA | | | | | | 86.560 | | | | | | |
| AGRNTLC | | | | | | | 18.874 | | | | | |
| AGRNTSH | | | | | | | 12.172 | | | | | |
| ACOTLC | | | | | | | | 183.886 | | | | |
| ACOTSH | | | | | | | | 200.549 | | | | |
| ASUG | | | | | | | | | 263.735 | | | |
| ATOB | | | | | | | | | | 2,663.388 | | |
| AOCRPLC | | | | | | | | | | | 245.711 | |
| AOCRPSH | | | | | | | | | | | 39.749 | |
| ACATLC | | | | | | | | | | | | 466.426 |
| ACATSH | | | | | | | | | | | | 266.225 |
| AOLVKLC | | | | | | | | | | | | |
| AOLVKSH | | | | | | | | | | | | |
| AFISH | | | | | | | | | | | | |
| AFORLC | | | | | | | | | | | | |
| AFORSH | | | | | | | | | | | | |
| AMIN | | | | | | | | | | | | |
| AGRMIL | | | | | | | | | | | | |
| AOFDP | | | | | | | | | | | | |
| ATEXT | | | | | | | | | | | | |
| AOLGT | | | | | | | | | | | | |
| AFERT | | | | | | | | | | | | |
| AOMAN | | | | | | | | | | | | |
| AELWA | | | | | | | | | | | | |
| ACONS | | | | | | | | | | | | |
| ATDTP | | | | | | | | | | | | |
| APUB | | | | | | | | | | | | |
| APRIV | | | | | | | | | | | | |

Appendix Table 11 — cont'd: Absorption table

| | CMZ | CWT | COGRN | CHORT | CCOF | CTEA | CGRNT | CCOT | CSUG | CTOB | COCRP | CCAT |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMZ | | | | | | | | | | | | |
| CWT | | | | | | | | | | | | |
| COGRN | | | | | | | | | | | | |
| CHORT | | | | | | | | | | | | |
| CCOF | | | | | | | | | | | | |
| CTEA | | | | | | | | | | | | |
| CGRNT | | | | | | | | | | | | |
| CCOT | | | | | | | | | | | | |
| CSUG | | | | | | | | | | | | |
| CTOB | | | | | | | | | | | | |
| COCRP | | | | | | | | | | | | |
| CCAT | | | | | | | | | | | | |
| COLVK | | | | | | | | | | | | |
| CFISH | | | | | | | | | | | | |
| CFOR | | | | | | | | | | | | |
| CMIN | | | | | | | | | | | | |
| CGRMIL | | | | | | | | | | | | |
| COFDP | | | | | | | | | | | | |
| CTEXT | | | | | | | | | | | | |
| COLGT | | | | | | | | | | | | |
| CFERT | | | | | | | | | | | | |
| COMAN | | | | | | | | | | | | |
| CELWA | | | | | | | | | | | | |
| CCONS | | | | | | | | | | | | |
| CTDTP | | | | | | | | | | | | |
| CTDTP-E | 12.135 | | | 3.180 | 16.394 | 8.983 | 1.751 | 32.678 | 20.167 | 479.364 | | |
| CTDTP-M | | 3.099 | 1.821 | 0.935 | | | | | | 3.056 | | |
| CTDTP-D | 33.860 | 22.210 | 4.541 | 48.935 | 6.764 | 8.493 | 4.382 | 34.035 | 30.621 | 127.272 | 55.495 | 149.756 |
| CPUB | | | | | | | | | | | | |
| CPRIV | | | | | | | | | | | | |
| LABUSKLS | | | | | | | | | | | | |
| LABUSKF | | | | | | | | | | | | |
| LABUSKIF | | | | | | | | | | | | |
| LABSK | | | | | | | | | | | | |
| CAPLSC | | | | | | | | | | | | |
| CAPSH | | | | | | | | | | | | |
| CAPOT | | | | | | | | | | | | |
| LANDLS | | | | | | | | | | | | |
| LANDSH | | | | | | | | | | | | |
| ENT | | | | | | | | | | | | |
| HLSUPP | | | | | | | | | | | | |
| HLSLOW | | | | | | | | | | | | |
| HSHHLD | | | | | | | | | | | | |
| HURBUPP | | | | | | | | | | | | |
| HURBLOW | | | | | | | | | | | | |
| GOV | | | | | | | | | | | | |
| DTAX | | | | | | | | | | | | |
| ITAX | | | | | | | | | | | | |
| IMPTAR | | 3.033 | 1.964 | 1.077 | | | | | | 3.643 | | |
| SAVINV | | | | | | | | | | | | |
| DSTOCK | | | | | | | | | | | | |
| ROW | | 16.666 | 11.017 | 4.764 | | | | | | 15.568 | | |
| TOTAL | 375.703 | 169.542 | 44.638 | 282.575 | 137.709 | 104.036 | 37.180 | 451.148 | 314.523 | 3,292.292 | 340.955 | 882.408 |

Appendix Table 11 — cont'd: Absorption table

| | COLVK | CFISH | CFOR | CMIN | CGRMIL | COFDP | CTEXT | COLGT | CFERT | COMAN | CELWA | CCONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AMZLC | | | | | | | | | | | | |
| AMZSH | | | | | | | | | | | | |
| AWT | | | | | | | | | | | | |
| AOGRNLC | | | | | | | | | | | | |
| AOGRNSH | | | | | | | | | | | | |
| AHORTLC | | | | | | | | | | | | |
| AHORTSH | | | | | | | | | | | | |
| ACOF | | | | | | | | | | | | |
| ATEA | | | | | | | | | | | | |
| AGRNTLC | | | | | | | | | | | | |
| AGRNTSH | | | | | | | | | | | | |
| ACOTLC | | | | | | | | | | | | |
| ACOTSH | | | | | | | | | | | | |
| ASUG | | | | | | | | | | | | |
| ATOB | | | | | | | | | | | | |
| AOCRPLC | | | | | | | | | | | | |
| AOCRPSH | | | | | | | | | | | | |
| ACATLC | | | | | | | | | | | | |
| ACATSH | | | | | | | | | | | | |
| AOLVKLC | 546.514 | | | | | | | | | | | |
| AOLVKSH | 3.540 | | | | | | | | | | | |
| AFISH | | 59.689 | | | | | | | | | | |
| AFORLC | | | 44.364 | | | | | | | | | |
| AFORSH | | | 0.342 | | | | | | | | | |
| AMIN | | | | 2,019.876 | | | | | | | | |
| AGRMIL | | | | | 445.203 | | | | | | | |
| AOFDP | | | | | | 3,756.142 | | | | | | |
| ATEXT | | | | | | | 1,801.696 | | | | | |
| AOLGT | | | | | | | | 3,077.177 | | | | |
| AFERT | | | | | | | | | 475.574 | | | |
| AOMAN | | | | | | | | | | 6,283.679 | | |
| AELWA | | | | | | | | | | | 1,069.277 | |
| ACONS | | | | | | | | | | | | 3,184.646 |
| ATDTP | | | | | | | | | | | | |
| APUB | | | | | | | | | | | | |
| APRIV | | | | | | | | | | | | |

Appendix Table 11 — cont'd: Absorption table

| | COLVK | CFISH | CFOR | CMIN | CGRMIL | COFDP | CTEXT | COLGT | CFERT | COMAN | CELWA | CCONS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMZ | | | | | | | | | | | | |
| CWT | | | | | | | | | | | | |
| COGRN | | | | | | | | | | | | |
| CHORT | | | | | | | | | | | | |
| CCOF | | | | | | | | | | | | |
| CTEA | | | | | | | | | | | | |
| CGRNT | | | | | | | | | | | | |
| CCOT | | | | | | | | | | | | |
| CSUG | | | | | | | | | | | | |
| CTOB | | | | | | | | | | | | |
| COCRP | | | | | | | | | | | | |
| CCAT | | | | | | | | | | | | |
| COLVK | | | | | | | | | | | | |
| CFISH | | | | | | | | | | | | |
| CFOR | | | | | | | | | | | | |
| CMIN | | | | | | | | | | | | |
| CGRMIL | | | | | | | | | | | | |
| COFDP | | | | | | | | | | | | |
| CTEXT | | | | | | | | | | | | |
| COLGT | | | | | | | | | | | | |
| CFERT | | | | | | | | | | | | |
| COMAN | | | | | | | | | | | | |
| CELWA | | | | | | | | | | | | |
| CCONS | | | | | | | | | | | | |
| CTDTP | | | | | | | | | | | | |
| CTDTP-E | 5.380 | | | 137.907 | | 44.271 | 18.695 | 22.437 | 1.448 | 181.197 | | |
| CTDTP-M | | | | 14.486 | | 32.710 | 55.140 | 43.936 | 50.138 | 1,483.960 | | |
| CTDTP-D | 112.072 | 11.392 | 6.853 | 123.469 | 320.797 | 830.084 | 273.487 | 368.540 | 136.235 | 735.079 | | |
| CPUB | | | | | | | | | | | | |
| CPRIV | | | | | | | | | | | | |
| LABUSKLS | | | | | | | | | | | | |
| LABUSKF | | | | | | | | | | | | |
| LABUSKIF | | | | | | | | | | | | |
| LABSK | | | | | | | | | | | | |
| CAPLSC | | | | | | | | | | | | |
| CAPSH | | | | | | | | | | | | |
| CAPOT | | | | | | | | | | | | |
| LANDLS | | | | | | | | | | | | |
| LANDSH | | | | | | | | | | | | |
| ENT | | | | | | | | | | | | |
| HLSUPP | | | | | | | | | | | | |
| HLSLOW | | | | | | | | | | | | |
| HSHHLD | | | | | | | | | | | | |
| HURBUPP | | | | | | | | | | | | |
| HURBLOW | | | | | | | | | | | | |
| GOV | | | | | | | | | | | | |
| DTAX | | | | | | | | | | | | |
| ITAX | | | | | | | | | | | | |
| IMPTAR | | | | 24.471 | | 38.337 | 82.522 | 139.019 | 48.527 | 1,466.925 | | |
| SAVINV | | | | | | | | | | | | |
| DSTOCK | | | | | | | | | | | | |
| ROW | | | | 100.162 | | 158.322 | 296.536 | 425.317 | 323.567 | 6,245.708 | | |
| TOTAL | 667.506 | 71.081 | 51.558 | 2,420.373 | 766.000 | 4,859.867 | 2,528.076 | 4,076.426 | 1,035.489 | 16,396.547 | 1,069.277 | 3,184.646 |

Appendix Table 11 — cont'd: Absorption and institutional table

| | CTDTP | CTDTP-E | CTDTP-M | CTDTP-D | CPUB | CPRIV | LABUSKLS | LABUSKF | LABUSKIF | LABSK | CAPLSC | CAPSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AMZLC | | | | | | | | | | | | |
| AMZSH | | | | | | | | | | | | |
| AWT | | | | | | | | | | | | |
| AOGRNLC | | | | | | | | | | | | |
| AOGRNSH | | | | | | | | | | | | |
| AHORTLC | | | | | | | | | | | | |
| AHORTSH | | | | | | | | | | | | |
| ACOF | | | | | | | | | | | | |
| ATEA | | | | | | | | | | | | |
| AGRNTLC | | | | | | | | | | | | |
| AGRNTSH | | | | | | | | | | | | |
| ACOTLC | | | | | | | | | | | | |
| ACOTSH | | | | | | | | | | | | |
| ASUG | | | | | | | | | | | | |
| ATOB | | | | | | | | | | | | |
| AOCRPLC | | | | | | | | | | | | |
| AOCRPSH | | | | | | | | | | | | |
| ACATLC | | | | | | | | | | | | |
| ACATSH | | | | | | | | | | | | |
| AOLVKLC | | | | | | | | | | | | |
| AOLVKSH | | | | | | | | | | | | |
| AFISH | | | | | | | | | | | | |
| AFORLC | | | | | | | | | | | | |
| AFORSH | | | | | | | | | | | | |
| AMIN | | | | | | | | | | | | |
| AGRMIL | | | | | | | | | | | | |
| AOFDP | | | | | | | | | | | | |
| ATEXT | | | | | | | | | | | | |
| AOLGT | | | | | | | | | | | | |
| AFERT | | | | | | | | | | | | |
| AOMAN | | | | | | | | | | | | |
| AELWA | | | | | | | | | | | | |
| ACONS | | | | | | | | | | | | |
| ATDTP | 8,263.137 | | | | | | | | | | | |
| APUB | | | | | 4,863.472 | | | | | | | |
| APRIV | | | | | | 6,663.621 | | | | | | |

Appendix Table 11 — cont'd: Absorption and institutional table

| | CTDTP | CTDTP-E | CTDTP-M | CTDTP-D | CPUB | CPRIV | LABUSKLS | LABUSKF | LABUSKIF | LABSK | CAPLSC | CAPSH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| CMZ | | | | | | | | | | | | |
| CWT | | | | | | | | | | | | |
| COGRN | | | | | | | | | | | | |
| CHORT | | | | | | | | | | | | |
| CCOF | | | | | | | | | | | | |
| CTEA | | | | | | | | | | | | |
| CGRNT | | | | | | | | | | | | |
| CCOT | | | | | | | | | | | | |
| CSUG | | | | | | | | | | | | |
| CTOB | | | | | | | | | | | | |
| COCRP | | | | | | | | | | | | |
| CCAT | | | | | | | | | | | | |
| COLVK | | | | | | | | | | | | |
| CFISH | | | | | | | | | | | | |
| CFOR | | | | | | | | | | | | |
| CMIN | | | | | | | | | | | | |
| CGRMIL | | | | | | | | | | | | |
| COFDP | | | | | | | | | | | | |
| CTEXT | | | | | | | | | | | | |
| COLGT | | | | | | | | | | | | |
| CFERT | | | | | | | | | | | | |
| COMAN | | | | | | | | | | | | |
| CELWA | | | | | | | | | | | | |
| CCONS | | | | | | | | | | | | |
| CTDTP | | 985.989 | 1,689.281 | 3,444.372 | | | | | | | | |
| CTDTP-E | | | | | | | | | | | | |
| CTDTP-M | | | | | | | | | | | | |
| CTDTP-D | | | | | | | | | | | | |
| CPUB | | | | | | | | | | | | |
| CPRIV | | | | | | | | | | | | |
| LABUSKLS | | | | | | | | | | | | |
| LABUSKF | | | | | | | | | | | | |
| LABUSKIF | | | | | | | | | | | | |
| LABSK | | | | | | | | | | | | |
| CAPLSC | | | | | | | | | | | | |
| CAPSH | | | | | | | | | | | | |
| CAPOT | | | | | | | | | | | | |
| LANDLS | | | | | | | | | | | | |
| LANDSH | | | | | | | | | | | | |
| ENT | | | | | | | | | | | | |
| HLSUPP | | | | | | | | | | 810.446 | 1,719.072 | |
| HLSLOW | | | | | | | 99.675 | | | | | |
| HSHHLD | | | | | | | | | 694.726 | | | 260.048 |
| HURBUPP | | | | | | | | | | 8,984.794 | | |
| HURBLOW | | | | | | | | 752.294 | 1,482.780 | | | |
| GOV | | | | | | | | | | | | |
| DTAX | | | | | | | | | | | | |
| ITAX | | | | | | | | | | | | |
| IMPTAR | | | | | | 51.483 | | | | | | |
| SAVINV | | | | | | | | | | | | |
| DSTOCK | | | | | | | | | | | | |
| ROW | | | | | | 450.372 | | | | 26.000 | | |
| TOTAL | 8,263.137 | 985.989 | 1,689.281 | 3,444.372 | 4,863.472 | 7,165.476 | 99.675 | 752.294 | 2,177.506 | 9,821.240 | 1,719.072 | 260.048 |

Appendix Table 11— cont'd: Institutional table

| | CAPOT | LANDLS | LANDSH | ENT | HLSUPP | HLSLOW | HSHHLD | HURBUPP | HURBLOW | GOV |
|---|---|---|---|---|---|---|---|---|---|---|
| AMZLC | | | | | | | | | | |
| AMZSH | | | | | | | 204.154 | | | |
| AWT | | | | | | | | | | |
| AOGRNLC | | | | | | | | | | |
| AOGRNSH | | | | | | | 72.672 | | | |
| AHORTLC | | | | | | | | | | |
| AHORTSH | | | | | | | 72.930 | | | |
| ACOF | | | | | | | | | | |
| ATEA | | | | | | | | | | |
| AGRNTLC | | | | | | | | | | |
| AGRNTSH | | | | | | | 78.119 | | | |
| ACOTLC | | | | | | | | | | |
| ACOTSH | | | | | | | | | | |
| ASUG | | | | | | | | | | |
| ATOB | | | | | | | | | | |
| AOCRPLC | | | | | | | | | | |
| AOCRPSH | | | | | | | | | | |
| ACATLC | | | | | | | | | | |
| ACATSH | | | | | | | 101.236 | | | |
| AOLVKLC | | | | | | | | | | |
| AOLVKSH | | | | | | | 121.914 | | | |
| AFISH | | | | | | | | | | |
| AFORLC | | | | | | | | | | |
| AFORSH | | | | | | | 33.976 | | | |
| AMIN | | | | | | | | | | |
| AGRMIL | | | | | | | | | | |
| AOFDP | | | | | | | | | | |
| ATEXT | | | | | | | | | | |
| AOLGT | | | | | | | | | | |
| AFERT | | | | | | | | | | |
| AOMAN | | | | | | | | | | |
| AELWA | | | | | | | | | | |
| ACONS | | | | | | | | | | |
| ATDTP | | | | | | | | | | |
| APUB | | | | | | | | | | |
| APRIV | | | | | | | | | | |

Appendix Table 11 — cont'd: Institutional table

| | CAPOT | LANDLS | LANDSH | ENT | HLSUPP | HLSLOW | HSHHLD | HURBUPP | HURBLOW | GOV |
|---|---|---|---|---|---|---|---|---|---|---|
| CMZ | | | | | | 12.789 | 37.758 | | 178.911 | |
| CWT | | | | | | | | | | |
| COGRN | | | | | 14.452 | 2.218 | 6.375 | 21.593 | | |
| CHORT | | | | | 45.547 | 6.338 | 7.885 | 111.947 | 90.893 | |
| CCOF | | | | | | | | | | |
| CTEA | | | | | | | | | | |
| CGRNT | | | | | | | | | | |
| CCOT | | | | | | | | | | |
| CSUG | | | | | | | | | | |
| CTOB | | | | | | | | | | |
| COCRP | | | | | | 3.012 | 13.116 | | 46.521 | |
| CCAT | | | | | 167.654 | 1.995 | 25.362 | | | |
| COLVK | | | | | 160.820 | 7.787 | 49.162 | | 118.593 | |
| CFISH | | | | | 24.604 | 0.551 | 6.558 | 29.673 | 9.695 | |
| CFOR | | | | | 9.343 | | 12.533 | 20.809 | | |
| CMIN | | | | | | | | | | |
| CGRMIL | | | | | 306.765 | 11.757 | 60.628 | 175.286 | 180.684 | |
| COFDP | | | | | 1,468.304 | 11.213 | 192.417 | 1,895.538 | 371.624 | 39.749 |
| CTEXT | | | | | 405.294 | 3.017 | 38.187 | 500.178 | 70.843 | |
| COLGT | | | | | 1,271.068 | 23.715 | 277.276 | 1,375.635 | 488.545 | 66.853 |
| CFERT | | | | | | | | 43.729 | | |
| COMAN | | | | | 1,081.586 | 4.902 | 80.241 | 1,968.591 | 185.273 | 203.824 |
| CELWA | | | | | 114.110 | 0.831 | 10.492 | 406.835 | 70.500 | 19.582 |
| CCONS | | | | | | | | | | |
| CTDTP | | | | | 542.576 | 3.007 | 59.692 | 591.971 | 69.938 | 169.376 |
| CTDTP-E | | | | | | | | | | |
| CTDTP-M | | | | | | | | | | |
| CTDTP-D | | | | | | | | | | |
| CPUB | | | | | 219.442 | 3.478 | 84.366 | 163.983 | 48.476 | 2,884.525 |
| CPRIV | | | | | 1,387.398 | 1.139 | 91.684 | 1,704.714 | 166.578 | 1,391.092 |
| LABUSKLS | | | | | | | | | | |
| LABUSKF | | | | | | | | | | |
| LABUSKIF | | | | | | | | | | |
| LABSK | | | | | | | | | | |
| CAPLSC | | | | | | | | | | |
| CAPSH | | | | | | | | | | |
| CAPOT | | | | | | | | | | |
| LANDLS | | | | | | | | | | |
| LANDSH | | | | | | | | | | |
| ENT | 10,733.122 | | | | | | | | | 1,209.000 |
| HLSUPP | | 457.532 | | 5,526.096 | | | | | | 635.190 |
| HLSLOW | | | | | | | | | | |
| HSHHLD | | | 136.802 | | | | | 79.105 | 180.345 | 477.915 |
| HURBUPP | | | | 3,306.025 | | | | | | 106.734 |
| HURBLOW | 126.709 | | | | | | | | | 239.161 |
| GOV | | | | | | | | | | |
| DTAX | | | | 1,667.000 | 687.887 | | 20.947 | 1,239.894 | 111.273 | |
| ITAX | | | | | | | | | | |
| IMPTAR | | | | | | | | | | |
| SAVINV | | | | 908.000 | 1,343.487 | 1.925 | 69.263 | 2,068.071 | 212.253 | (504.000) |
| DSTOCK | | | | | | | | | | |
| ROW | | | | 535.000 | | | | | | 418.000 |
| TOTAL | 10,859.831 | 457.532 | 136.802 | 11,942.122 | 9,250.337 | 99.675 | 1,828.941 | 12,397.553 | 2,600.944 | 7,357.000 |

Appendix Table 11 — cont'd: Institutional table

| | DTAX | ITAX | IMPTAR | SAVINV | DSTOCK | ROW | TOTAL |
|---|---|---|---|---|---|---|---|
| AMZLC | | | | | | | 197.804 |
| AMZSH | | | | | | | 336.057 |
| AWT | | | | | | | 124.535 |
| AOGRNLC | | | | | | | 20.804 |
| AOGRNSH | | | | | | | 77.164 |
| AHORTLC | | | | | | | 212.813 |
| AHORTSH | | | | | | | 83.800 |
| ACOF | | | | | | | 114.552 |
| ATEA | | | | | | | 86.560 |
| AGRNTLC | | | | | | | 18.874 |
| AGRNTSH | | | | | | | 90.291 |
| ACOTLC | | | | | | | 183.886 |
| ACOTSH | | | | | | | 200.549 |
| ASUG | | | | | | | 263.735 |
| ATOB | | | | | | | 2,663.388 |
| AOCRPLC | | | | | | | 245.711 |
| AOCRPSH | | | | | | | 39.749 |
| ACATLC | | | | | | | 466.426 |
| ACATSH | | | | | | | 367.461 |
| AOLVKLC | | | | | | | 546.514 |
| AOLVKSH | | | | | | | 125.454 |
| AFISH | | | | | | | 59.689 |
| AFORLC | | | | | | | 44.364 |
| AFORSH | | | | | | | 34.317 |
| AMIN | | | | | | | 2,019.876 |
| AGRMIL | | | | | | | 445.203 |
| AOFDP | | | | | | | 3,756.142 |
| ATEXT | | | | | | | 1,801.696 |
| AOLGT | | | | | | | 3,077.177 |
| AFERT | | | | | | | 475.574 |
| AOMAN | | | | | | | 6,283.679 |
| AELWA | | | | | | | 1,069.277 |
| ACONS | | | | | | | 3,184.646 |
| ATDTP | | | | | | | 8,263.137 |
| APUB | | | | | | | 4,863.472 |
| APRIV | | | | | | | 6,663.621 |

Appendix Table 11— cont'd: Institutional table

| | DTAX | ITAX | IMPTAR | SAVINV | DSTOCK | ROW | TOTAL |
|---|---|---|---|---|---|---|---|
| CMZ | | | | | | 73.421 | 375.703 |
| CWT | | | | | | | 169.542 |
| COGRN | | | | | | | 44.638 |
| CHORT | | | | | | 16.203 | 282.575 |
| CCOF | | | | | | 83.523 | 137.709 |
| CTEA | | | | | | 45.768 | 104.036 |
| CGRNT | | | | | | 8.924 | 37.180 |
| CCOT | | | | | | 166.491 | 451.148 |
| CSUG | | | | | | 102.750 | 314.523 |
| CTOB | | | | | | 2,442.304 | 3,292.292 |
| COCRP | | | | | | | 340.955 |
| CCAT | | | | | (13.197) | | 882.408 |
| COLVK | | | | | (17.109) | 24.798 | 667.506 |
| CFISH | | | | | | | 71.081 |
| CFOR | | | | | | | 51.558 |
| CMIN | | | | | | 889.986 | 2,420.373 |
| CGRMIL | | | | | | | 766.000 |
| COFDP | | | | | (165.863) | 178.565 | 4,859.867 |
| CTEXT | | | | | | 120.649 | 2,528.076 |
| COLGT | | | | | (228.426) | 144.800 | 4,076.426 |
| CFERT | | | | | | 9.344 | 1,035.489 |
| COMAN | | | | 3,399.004 | (100.112) | 1,169.355 | 16,396.547 |
| CELWA | | | | | | | 1,069.277 |
| CCONS | | | | 2,783.702 | | | 3,184.646 |
| CTDTP | | | | | | | 8,263.137 |
| CTDTP-E | | | | | | | 985.989 |
| CTDTP-M | | | | | | | 1,689.281 |
| CTDTP-D | | | | | | | 3,444.372 |
| CPUB | | | | | | | 4,863.472 |
| CPRIV | | | | | | 1,598.118 | 7,165.476 |
| LABUSKLS | | | | | | | 99.675 |
| LABUSKF | | | | | | | 752.294 |
| LABUSKIF | | | | | | | 2,177.506 |
| LABSK | | | | | | | 9,821.240 |
| CAPLSC | | | | | | | 1,719.072 |
| CAPSH | | | | | | | 260.048 |
| CAPOT | | | | | | | 10,859.831 |
| LANDLS | | | | | | | 457.532 |
| LANDSH | | | | | | | 136.802 |
| ENT | | | | | | | 11,942.122 |
| HLSUPP | | | | | | 102.000 | 9,250.337 |
| HLSLOW | | | | | | | 99.675 |
| HSHHLD | | | | | | | 1,828.941 |
| HURBUPP | | | | | | | 12,397.553 |
| HURBLOW | | | | | | | 2,600.944 |
| GOV | 3,727.000 | 1,478.000 | 1,861.000 | | | 291.000 | 7,357.000 |
| DTAX | | | | | | | 3,727.000 |
| ITAX | | | | | | | 1,478.000 |
| IMPTAR | | | | | | | 1,861.000 |
| SAVINV | | | | | | 1,559.000 | 5,658.000 |
| DSTOCK | | | | (524.706) | | | (524.706) |
| ROW | | | | | | | 9,027.000 |
| TOTAL | 3,727.000 | 1,478.000 | 1,861.000 | 5,658.000 | (524.706) | 9,027.000 | 211,466.147 |

**Appendix Table 12 The Zimbabwe macro SAM, 1991 (after entropy)**

| | Activities | Commodities | Factors | Enterprises | Household | Government | Capital | World | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| **Activities** | | 47,823 | | | 685 | | | | **48,508** |
| **Commodities** | 20,746 | 6,120 | | | 19,478 | 4,775 | 5,658 | 7,075 | **63,852** |
| **Factors** | 26,284 | | | | | | | | **26,284** |
| **Enterprises** | | | 10,733 | | | 1,209 | | | **11,942** |
| **Household** | | | 15,525 | 8,832 | 259 | 1,459 | | 102 | **26,177** |
| **Government** | 1,478 | 1,861 | | 1,667 | 2,060 | | | 291 | **7,357** |
| **Capital** | | | | 908 | 3,695 | -504 | | 1,559 | **5,658** |
| **World** | | 8,048 | 26 | 535 | | 418 | | | **9,027** |
| **Total** | **48,508** | **63,852** | **26,284** | **11,942** | **26,178** | **7,357** | **5,658** | **9,027** | |

Appendix Table 13 — GAMS code for entropy model specifications

```
*Zimbabwe sammaker
*Marcelle Thomas

*#########################################################
* Input tables:    complete but unbalanced micro SAM:
*                  complete and balanced macro SAM :
*                  sectoral national account aggregates: NATAB
*                  agricultural sector output and value added: AGRTAB
*#########################################################
* The SAMs can be imported directly from spreadsheets or as *.dat files
* The smaller tables are just included in the program code as GAMS tables

*=======================  ENTROPY RAS ==========================

PARAMETER
  SAM1(aac,aacp)                micro sam unbalanced
  MACSAM1(acmac,acmacp)         control total macro sam
  HCONSH0(C,h)                  household consumption expenditure shares
;
  SAM1(aac,aacp)       = SAM(aac,aacp);
  MACSAM1(acmac,acmacp)  = MACSAMD(acmac,acmacp);
  HCONSH0(c,h)$SAM1(c,h) = SAM1(c,h)/sum(cp,SAM1(cp,h));

PARAMETER
  BALCHK(AAC)           column total minus row total
  MACDIF(acmac,acmacp)          Macro SAM difference (MACSAM - MACSAM1)
  RELDEV(AAC)           dev as % of column total
;

*## RECOMPUTE SAM TOTALS AND CHECK ROW COLUMN TOTALS BALANCE

SAM1("total",aacp) = 0;
SAM1(aac,"total") = 0;

SAM1("TOTAL",aacp) = SUM(aac, SAM1(aac,aacp));
SAM1(aac,"TOTAL") = SUM(aacp, SAM1(aac,aacp));

MACSAM1("TOTAL1",acmacp) = 0;
MACSAM1(acmac,"TOTAL1") = 0;

MACSAM1("TOTAL1",acmacp) = SUM(acmac, MACSAM1(acmac,acmacp));
MACSAM1(acmac,"TOTAL1") = SUM(acmacp, MACSAM1(acmac,acmacp));

BALCHK(aacp)   = SAM1("TOTAL",aacp) - SAM1(aacp,"TOTAL");

DISPLAY BALCHK;

*================ GENERATE NON NEGATIVE SAMs ====================

*The Entropy RAS cannot be carried out with negative numbers because of
*of  log operations.
*The option  used here is to detect any negative flows and net them out
*of their respective symmetric cells. After the RAS, if the symmetric
*cell was previously zero it is set to zero and its value is placed
*with a negative sign in the original symmetric cell.

SETS

 red(aac,aacp)                signals negative flows for micro sam
 reswitch(aac,aacp)           signals a flow in micro sam must return to its original cell
 ;

 red(aacnt,aacntp)$(SAM1(aacnt,aacntp) LT 0)      = yes ;
 reswitch(aacnt,aacntp)$(SAM1(aacnt,aacntp) EQ 0) = yes ;

 SAM1(aacntp,aacnt)$red(aacnt,aacntp) = - SAM1(AACnt,AACntp) ;
 SAM1(aacnt,aacntp)$red(aacnt,aacntp) = 0.0 ;

 SAM1(aacnt,"TOTAL")  = SUM(aacntp, SAM1(aacnt,aacntp)) ;
 SAM1("TOTAL",aacntp) = SUM(aacnt, SAM1(aacnt,aacntp)) ;


SETS

 red2(acmac,acmacp)           signals negative flows in control macro sam
 reswitch2(acmac,acmacp) signals a flow in macro sam must return to its original cell
;

 red2(acmacnt,acmacntp)$(MACSAM1(acmacnt,acmacntp) LT 0)      = yes ;
 reswitch2(acmacnt,acmacntp)$(MACSAM1(acmacnt,acmacntp) EQ 0) = yes ;

 MACSAM1(acmacntp,acmacnt)$red2(acmacnt,acmacntp) = - MACSAM1(acmacnt,acmacntp) ;
 MACSAM1(acmacnt,acmacntp)$red2(acmacnt,acmacntp) = 0.0 ;

 MACSAM1(acmacnt,"TOTAL1")  = SUM(acmacntp, MACSAM1(acmacnt,acmacntp)) ;
 MACSAM1("TOTAL1",acmacntp) = SUM(acmacnt, MACSAM1(acmacnt,acmacntp)) ;

DISPLAY SAM1, MACSAM1;


*================ DEFINING THE CORE MODEL ======================

SETS

   cc(aac)          columns of SAM to be adjusted
   rr(aac)          rows of SAM to be adjusted
;

ALIAS(aacntp,aacntpp);

*For this version, adjust SAM over all accounts
   cc(aac)  = yes ;
   rr(aac)  = yes ;

PARAMETERS
   RASMAT0(aac,aacp)        base coefficient matrix
```

```
  DELTA                 adjustment to avoid values close to zero
  RASMATCHK(AAC)        check that columns sum to unity
;

 DELTA = .001;

*Initialize coefficient matrix

 RASMAT0(AACNT,AACNTP)$SAM1(AACNT,AACNTP)
     = SAM1(AACNT,AACNTP)/SAM1("TOTAL",AACNTP) ;

 RASMATCHK(AACNT) =  SUM(AACNTP, RASMAT0(AACNTP,AACNT));

display rasmat0, RASMATCHK;

*## CORE VARIABLES

VARIABLES

   XXB(AAC,AACP)         Estimated cell values
   RASMAT(AAC,AACp)  Estimated coefficient matrix
   DENTROPY              Entropy difference

 ;

EQUATIONS

   ENTROPY               Entropy difference definition
   SUMCOEF(AACP)         SAM coefficient constraint (sum to unity)
   SAMDEF(AAC,AACP)  Definition of new SAM (from RASMAT variable)
   RCBALB(AAC)           Row and column balance constraint (equality)
   DOMSALCON(AAC)    Constraining exports to be less than dom output
 ;


*## CORE EQUATIONS

 ENTROPY..  DENTROPY =E=
          SUM((AACNT,AACNTP)$(rasmat0(AACNT,AACNTP) gt 0),
          RASMAT(AACNT,AACNTP)*(LOG(RASMAT(AACNT,AACNTP) + delta)
         - LOG(rasmat0(AACNT,AACNTP) + delta) ));


 SUMCOEF(AACNTP)..  SUM(AACNT, RASMAT(AACNT,AACNTP)) =E= 1 ;

 SAMDEF(AACNT,AACNTP)$RASMAT0(AACNT,AACNTP)..
            XXB(AACNT,AACNTP) =E= RASMAT(AACNT,AACNTP)
            *SUM(AACNTPP$RASMAT0(AACNTP,AACNTPP), XXB(AACNTP,AACNTPP));


 RCBALB(AACNTP)$SAM1(AACNTP,"TOTAL")..
*Row total for account ACNTP
     SUM(AACNT$SAM1(AACNTP,AACNT), XXB(AACNTP,AACNT))
*Column total for account ACNTP
     =E= SUM(AACNT$SAM1(AACNT,AACNTP), XXB(AACNT,AACNTP));

 DOMSALCON(C)$SAM1(C,"ROW").. XXB(C,"ROW") + 0.001 =L=
                SUM(A$SAM1(A,C), XXB(A,C));


*============== ADDITIONS TO CORE MODEL  ====================

*## EQUATIONS IMPOSING NEW INFORMATION

EQUATIONS

 COMACTC               Aggregate intermediate demand
 FACACTC               GDP at factor cost
 ITAXC                 Domestic indirect taxes

 MKTEEQ(C)             MARKETING MARGIN EQUATION EXPORT
 MKTMEQ(C)             MARKETING MARGIN EQUATION IMPORT
 MKTDEQ(C)             MARKETING MARGIN EQUATION DOMESTIC
 COMCOMC               Aggregate marketing margin
 IMPTARC               Aggregate import duties
 ROWCOMC               Aggregate imports

 ROWFACC               Factor payments to ROW--labor

 DTAXEC                Corporate taxes
 SAVENTC               Enterprises saving
 ROWENTC               Factor payments to ROW--capital

 ACTHOUC               Aggregate household own cosumption
 COMHOUC               Aggregate household consumption expenditure
 HOUHOUC               INTERHOUSEHOLD TRANSFERS
 DTAXHC                Household income taxes
 SAVHOUC               Household saving

 COMGREC                   Aggregate government consumption expenditure
 ENTGREC                   Gov. tranf. to enterprises(interest payments)
 HOUGREC                   Gov. tranf. to households--net lending
 SAVGREC                   Government saving --Budget deficit
 ROWGREC                   Government factor transfers to row--capital

 COMINVC                   Aggregate fixed capital formation

 COMROWC                   Aggregate exports
 HOUROWC                   Remittances from abroad
 GREROWC                   Foreign grants
 SAVROWC                   Foreign saving (current account deficit)

  VAAGRCON(AGR)            Value added by agricultural activity
 VADAGGCON(AAGGNT)        N.A. GDP f.c. by industry
 INTAGRCON(AGR)           Intermediate inputs use by agricultural activity
 INTINPCON(AAGGNT)        N.A. intermediate input use by industry

 ;


*## INTERMEDIATE DEMAND AND VALUE ADDED BY ACTIVITY
```

```
VADAGGCON(AAGGNT) .. SUM((F,A)$(MAAGG(aaggNT,A)$rasmat0(F,A)), XXB(F,A))
              =E= NATAB(aaggNT,"VALAD");


VAAGRCON(AGR) .. SUM(F$rasmat0(F,AGR), XXB(F,AGR))
             =E= AGRTAB(AGR,"VALAD");


INTINPCON(aaggNT) .. SUM((C,A)$(MAAGG(aaggNT,A)$rasmat0(C,A)), XXB(C,A))
              =E= NATAB(aaggNT,"INTINP");

INTAGRCON(AGR) .. SUM(C$rasmat0(C,AGR), XXB(C,AGR))
              =E= AGRTAB(AGR,"INTINP");

MKTEEQ(C)$CE(C)..
              XXB('CTDTP-E',C) =E= mmrn('CTDTP-E',C) * XXB(C,'ROW');

MKTMEQ(C)$CM(C)..
              XXB('CTDTP-M',C) =E= mmrn('CTDTP-M',C) * XXB('ROW',C);

MKTDEQ(C)..       XXB('CTDTP-D',C) =E= mmrn('CTDTP-D',C) *
              (SUM(A,XXB(A,C)) - XXB(C ,'ROW'));


*## MACROSAM  ENTRIES

 FACACTC..       SUM((F,A)$(MICMAC('FACT',F)$rasmat0(F,A)), XXB(F,A))
              =E= MACSAM1('FACT',"ACT");

*## HANDLING NEGATIVE VALUES PLACED IN SYMMETRIC CELLS
 ITAXC..         SUM(A$rasmat0("ITAX",A), XXB("ITAX",A))
              - SUM(A$rasmat0(A,"ITAX"), XXB(A,"ITAX"))
              =E= MACSAM1("GRE","ACT");

 IMPTARC..       SUM((C)$rasmat0("IMPTAR",C), XXB("IMPTAR",C))
              =E= MACSAM1("GRE","COM");

 ROWCOMC..       SUM((C)$rasmat0("ROW",C), XXB("ROW",C))
              =E= MACSAM1("WORLD1","COM");

 ROWFACC..       SUM(F$(MICMAC('FACT',F)$rasmat0("ROW",F)),XXB(F,'ROW'))
              =E= MACSAM1('WORLD1','FACT');

 DTAXEC..        XXB('DTAX','ENT')
             =E= MACSAM1('GRE','ENTP');

 SAVENTC..       XXB("SAVINV",'ENT')
             =E= MACSAM1("KACCT",'ENTP');

 ROWENTC..       XXB("ROW",'ENT')
             =E= MACSAM1("WORLD1",'ENTP');


 ACTHOUC..       SUM((A,H)$rasmat0(A,H), XXB(A,H))
             =E= MACSAM1("ACT","HOU");

 COMHOUC..       SUM((C,H)$rasmat0(C,H), XXB(C,H))
             =E= MACSAM1("COM","HOU");

 HOUHOUC..       SUM((H,HP)$rasmat0(H,HP), XXB(H,HP))
             =E= MACSAM1("HOU","HOU");

 DTAXHC..        SUM(H$(MICMAC('HOU',H)$rasmat0("DTAX",H)), XXB("DTAX",H))
             =E= MACSAM1("GRE","HOU");



 SAVHOUC..       SUM(H$(MICMAC('HOU',H)$rasmat0("SAVINV",H)), XXB("SAVINV",H))
             =E= MACSAM1("KACCT","HOU");


 COMGREC ..      SUM(C$rasmat0(C,"GOV"), XXB(C,"GOV"))
             =E= MACSAM1("COM","GRE");


 HOUGREC..       SUM(H$MICMAC('HOU',H), XXB(H,'GOV')$rasmat0(H,'GOV'))
             =E= MACSAM1('HOU','GRE');

 ENTGREC ..      XXB('ENT',"GOV")
             =E= MACSAM1('ENTP',"GRE");

*## HANDLING NEGATIVE VALUE IN BOTH SAMS

 SAVGREC..       XXB('GOV','SAVINV')
             =E= MACSAM1('GRE','KACCT');

 ROWGREC ..      XXB("ROW","GOV")
             =E= MACSAM1("WORLD1","GRE");

*## HANDLING NEGATIVE VALUES PLACED IN SYMMETRIC CELLS

 COMINVC ..      SUM(C$rasmat0(C,"SAVINV"), XXB(C,"SAVINV"))
             + SUM(C$rasmat0(C,"DSTOCK"), XXB(C,"DSTOCK"))
             - SUM(C$rasmat0('DSTOCK',C), XXB('DSTOCK',C))
             =E= MACSAM1("COM","KACCT");

 COMROWC..       SUM(C$rasmat0(C,"ROW"), XXB(C,"ROW"))
             =E= MACSAM1("COM","WORLD1");


 HOUROWC ..      SUM(H$(MICMAC('HOU',H)$rasmat0(H,"ROW")), XXB(H,"ROW"))
             =E= MACSAM1("HOU","WORLD1");


 GREROWC ..      XXB("GOV","ROW")
             =E= MACSAM1("GRE","WORLD1");


 SAVROWC ..      XXB("SAVINV","ROW")
             =E= MACSAM1("KACCT","WORLD1");
```

```
*## INITIALIZE  CELL VALUES

 XXB.L(AACNT,AACNTP)$rasmat0(AACNT,AACNTP)
            = SAM1(AACNT,AACNTP);

 RASMAT.L(AACNT,AACNTP)
            = rasmat0(AACNT,AACNTP) ;

 DENTROPY.L          = 0 ;

*## FIX SMALL COEFFICIENTS

 RASMAT.LO(AACNT,AACNTP)$rasmat0(AACNT,AACNTP) =
0.30*rasmat0(AACNT,AACNTP) ;


*================  SOLVE THE MODEL ==================

MODEL

 SAMENTROP
/
*Core equations
   ENTROPY
   SAMDEF
   SUMCOEF
   RCBALB
   DOMSALCON

*Equations imposing new information
*   COMACTC
   FACACTC
   ITAXC

   IMPTARC
   ROWCOMC

   ROWFACC

   DTAXEC
   SAVENTC
   ROWENTC

   ACTHOUC
   COMHOUC
   HOUHOUC
   DTAXHC
   SAVHOUC

   COMGREC
   ENTGREC
   HOUGREC
   SAVGREC
   ROWGREC

   COMINVC
   COMROWC
   HOUROWC
   GREROWC
   SAVROWC

   VAAGRCON
   VADAGGCON
   INTAGRCON
   INTINPCON
   MKTEEQ
   MKTMEQ
   MKTDEQ
   /

;
*## FIX FERTILIZER COEFFICIENTS

  RASMAT.FX('CFERT',crop)= RASMAT0('CFERT',crop);

*## FIX HOUSEHOLD CONSUMPTION SHARES WITHIN 5%  OF INITIAL LEVELS

  RASMAT.LO(C,H) = 0.05*RASMAT0(C,H);
  RASMAT.UP(C,H) = 1.05*RASMAT0(C,H);

*## FIX SUBSIDIES  ON MAIZE AND WHEAT WITHIN 5% OF INITIAL LEVELS.

 XXB.LO('AMZLC','ITAX')=.95* SAM1('AMZLC','ITAX');
 XXB.UP('AMZLC','ITAX')=1.05* SAM1('AMZLC','ITAX');
 XXB.LO('AMZSH','ITAX')=.95* SAM1('AMZSH','ITAX');
 XXB.UP('AMZSH','ITAX')=1.05* SAM1('AMZSH','ITAX');
 XXB.LO('AWT','ITAX')=.95* SAM1('AWT','ITAX');
 XXB.UP('AWT','ITAX')=1.05* SAM1('AWT','ITAX');


* OPTION ITERLIM  = 1200;
 OPTION ITERLIM  = 120000;
 OPTION RESLIM   = 1200000;
 OPTION LIMROW   = 2000, LIMCOL = 2000, SOLPRINT = ON;

  SAMENTROP.holdfixed = 1 ;
*When using CONOPT comment out the next two statement
  SAMENTROP.optfile   = 1 ;
  option NLP          = MINOS5 ;
*  OPTION NLP          = CONOPT;

*OPTIONS RESLIM=1500,ITERLIM=3000,LIMROW=100,LIMCOL=100,SOLPRINT=ON ;
 SAMENTROP.WORKSPACE=25.0;

SOLVE SAMENTROP minimizing dentropy using nlp ;

PARAMETER
 RHS(AGR) , LHS(AGR)
 RHST , LHST;

RHS(AGR) =  SUM(C, XXB.L(C,AGR));
```

```
LHS(AGR) =  AGRTAB(AGR,'INTINP');
RHST =  SUM(C,SUM(AGR, XXB.L(C,AGR)));
LHST =  SUM(AGR,AGRTAB(AGR,'INTINP'));
DISPLAY XXB.L, RHS, LHS,RHST,LHST;

*## CHECK CHANGES IN CELL VALUES RELATIVE TO ORIGINAL

PARAMETER
 RCDEVB(AAC,AACP)     relative cell deviation
 MAXRCDEVB           max relative cell deviation (RCDEVB)
 MINRCDEVB           min relative cell deviation (RCDEVB)
 CDEVB(AAC,AACP)      cell deviation
 MAXCDEVB            max cell deviation (CDEVB)
 MINCDEVB            min cell deviation (CDEVB)
 RASMATDIF(AAC,AACP)  optimal minus initial RASMAT matrix
 RRASMATDIF(AAC,AACP) relative RASMATDIF
;

 RCDEVB(AACNT,AACNTP)$SAM1(AACNT,AACNTP)
             = ((XXB.L(AACNT,AACNTP) - SAM1(AACNT,AACNTP) )
              / SAM1(AACNT,AACNTP) );

 MAXRCDEVB
             = SMAX((AACNT,AACNTP), RCDEVB(AACNT,AACNTP));


 MINRCDEVB
             = SMIN((AACNT,AACNTP), RCDEVB(AACNT,AACNTP));


 CDEVB(AACNT,AACNTP)$SAM1(AACNT,AACNTP)
             = ( XXB.L(AACNT,AACNTP) - SAM1(AACNT,AACNTP) );

 MAXCDEVB
             = SMAX((AACNT,AACNTP), CDEVB(AACNT,AACNTP));

 MINCDEVB
             = SMIN((AACNT,AACNTP), CDEVB(AACNT,AACNTP));

 RASMATDIF(AACNT,AACNTP)
             =  RASMAT.L(AACNT,AACNTP) - RASMAT0(AACNT,AACNTP);

 RRASMATDIF(AACNT,AACNTP)$RASMAT0(AACNT,AACNTP)
             = (RASMAT.L(AACNT,AACNTP) - RASMAT0(AACNT,AACNTP))
               /RASMAT0(AACNT,AACNTP);

DISPLAY MAXRCDEVB, MINRCDEVB, MAXCDEVB, MINCDEVB, RCDEVB, CDEVB
RASMATDIF, RRASMATDIF;


*## RETURNING ANY INITIAL NEGATIVE VALUES TO THEIR PROPER CELLS

 SAM1(AACNT,AACNTP)$SAM1(AACNT,AACNTP)
   = XXB.L(AACNT,AACNTP);

 SAM1(AACNT,AACNTP)$(red(AACNT,AACNTP)$reswitch(AACNTP,AACNT))
   = -SAM1(AACNTP,AACNT);
 SAM1(AACNTP,AACNT)$(red(AACNT,AACNTP)$reswitch(AACNTP,AACNT))
   = 0.0;


MACSAM1(ACMACNT,ACMACNTP)$(red2(ACMACNT,ACMACNTP)$reswitch2(ACMACNTP
,ACMACNT))
   = -MACSAM1(ACMACNTP,ACMACNT);


MACSAM1(ACMACNTP,ACMACNT)$(red2(ACMACNT,ACMACNTP)$reswitch2(ACMACNTP
,ACMACNT))
   = 0.0;

 SAM(aac,aacp)        = SAM1(aac,aacp) ;

*====================== END ENTROPY ==========================

*## Compute macro SAM from new balanced micro SAM

SAM("TOTAL",AACP) = 0;
SAM(AAC,"TOTAL")  = 0;

MACSAM("TOTAL1",ACMACP) = 0;
MACSAM(ACMAC,"TOTAL1")  = 0;

macsam(acmac,acmacp) = SUM((AAC,AACp)
                        $(MICMAC(acmac,AAC)
                        $MICMAC(acmacp,AACp)),
                         SAM(AAC,AACp));

MACSAM('COM','COM')  = SUM((MGN,C),SAM(MGN,C));
MACSAM('GRE','GRE')  = 0;
MACSAM('KACCT','KACCT') =0;

macsam("total1",acmacp) = SUM(ACMAC, macsam(acmac,acmacp));
macsam(acmac,"total1")  = SUM(ACMACP, macsam(acmac,acmacp));


SAM("TOTAL",AACP) = SUM(AAC,  SAM(AAC,AACP));
SAM(AAC,"TOTAL")  = SUM(AACP, SAM(AAC,AACP));

PARAMETER
 BALCHK3(AAC) column minus row total for account AAC;

BALCHK3(AAC) = SAM("TOTAL",AAC) - SAM(AAC,"TOTAL");


DISPLAY BALCHK3;

SAMCOEF(ACNT,ACNTP)$SAM(ACNT,ACNTP)
      = 0;

SAMCOEF(ACNT,ACNTP)$SAM(ACNT,ACNTP)
      = SAM(ACNT,ACNTP)/SAM("TOTAL",ACNTP) ;
```

```
DISPLAY "POST-BALANCE SAM AND HH PARAMETER VALUES" ;
DISPLAY HHPARMALL,SAM,SAMCOEF,MACSAM;

*## output files to spreadsheet
$LIBINCLUDE SSEXPORT SAM  MICSAM9.WK1 MIC
$LIBINCLUDE SSEXPORT SAMCOEF MICSAM9.WK1 COEF
$LIBINCLUDE SSEXPORT macsam ZIMMAC9.WK1 MAC
```

# LIST OF TMD DISCUSSION PAPERS

No. 1 - "Land, Water, and Agriculture in Egypt: The Economywide Impact of Policy Reform" by Sherman Robinson and Clemen Gehlhar (January 1995)

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